

N85 - 295 64

**Considerations for Space Station
Interior Architecture**

Brand Griffin

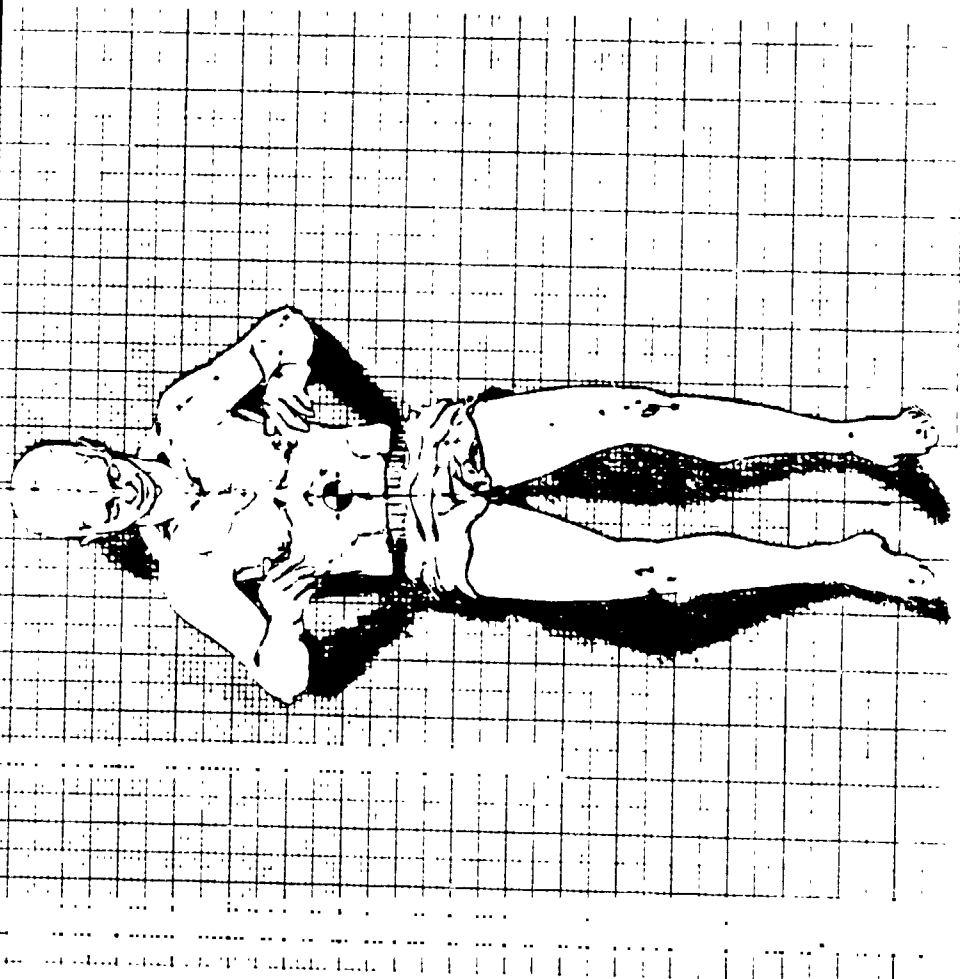
4-108



Space
Station

Neutral Body Postures

NASA
SS-1121

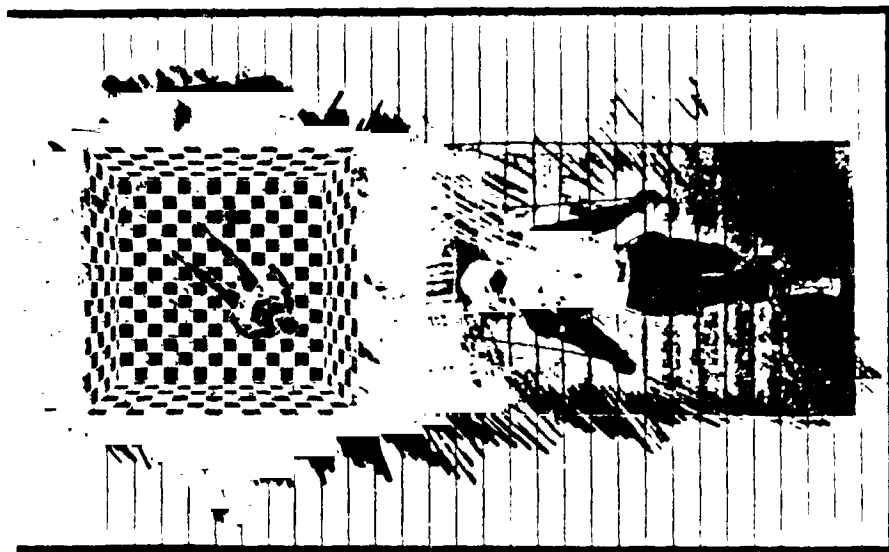




Space
Station

NASA
SS-1124

Contrasting Environments



CONTRASTING
OF POOR C...



Space
Station

Acceleration Gradient

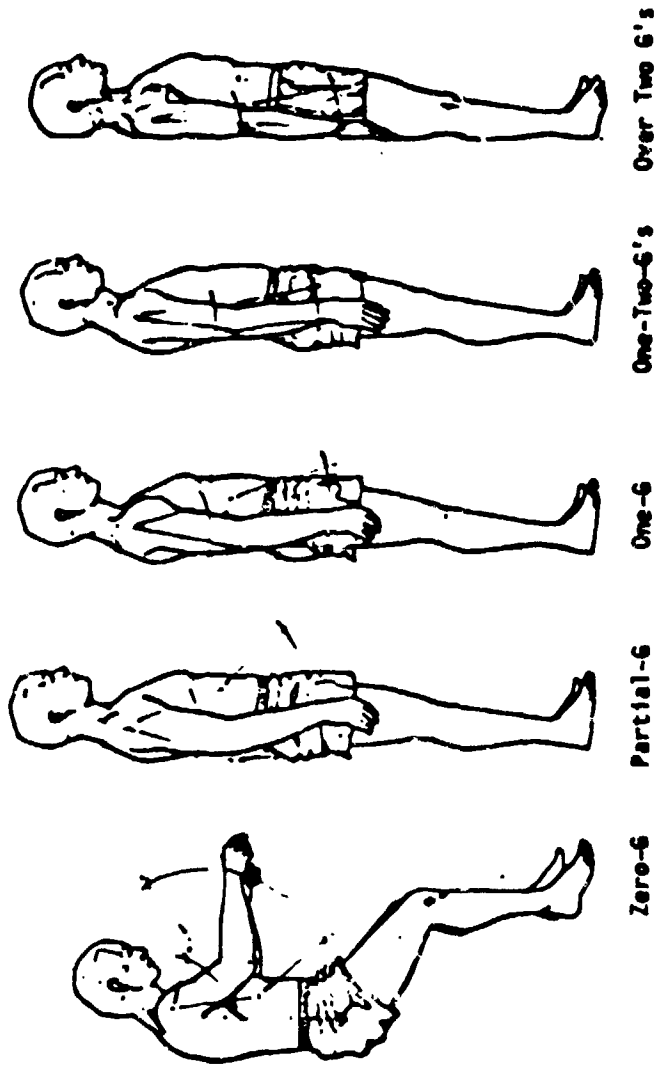
SS-1112

NASA

Variable:

Anthropometric Envelope
(Minimal)

Acceleration



Implications:

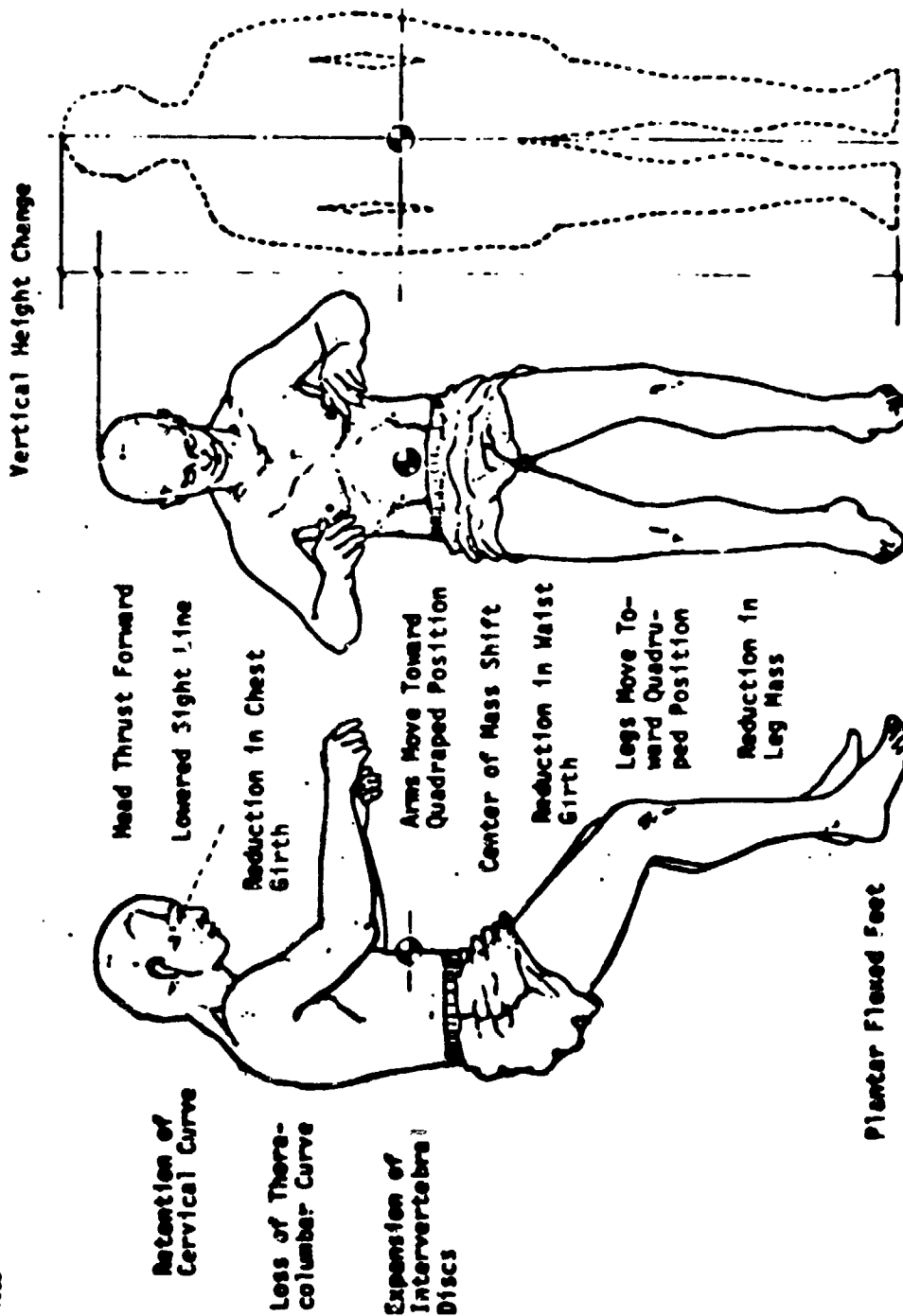
1. Location of controls.
2. Intravehicular and extravehicular garment fit.
3. Angular speed of limbs.



Space
Station

Anatomical Change in Zero-G

NASA
SP-1008





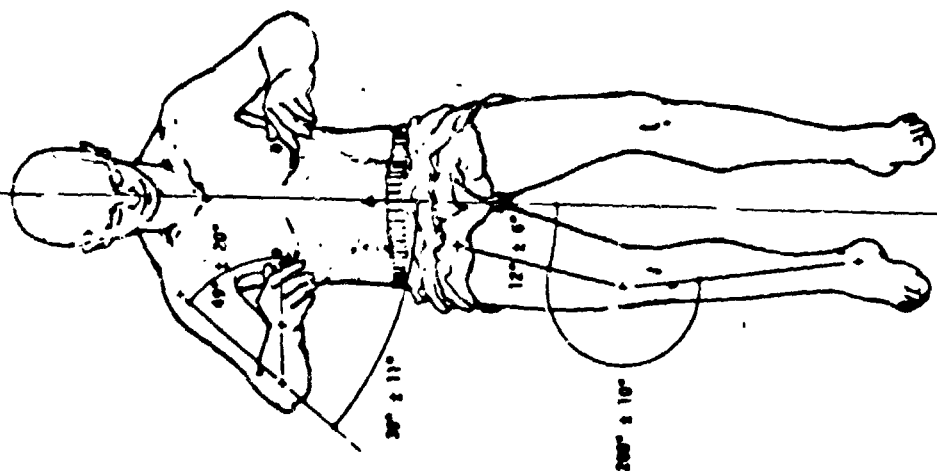
Space
Station

Male Angular Relationships Ventral View

NASA

SP-1114

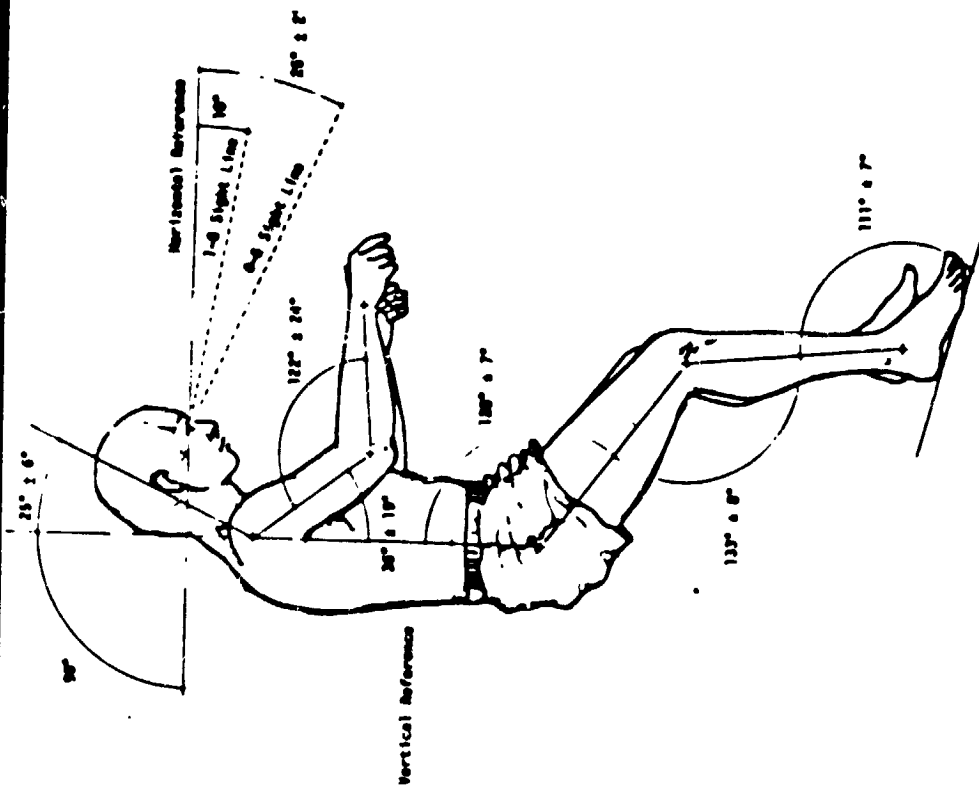
Vertical Reference





Male Angular Relationships

Profile View



ORIGINAL FIGURE
OF POOR QUALITY

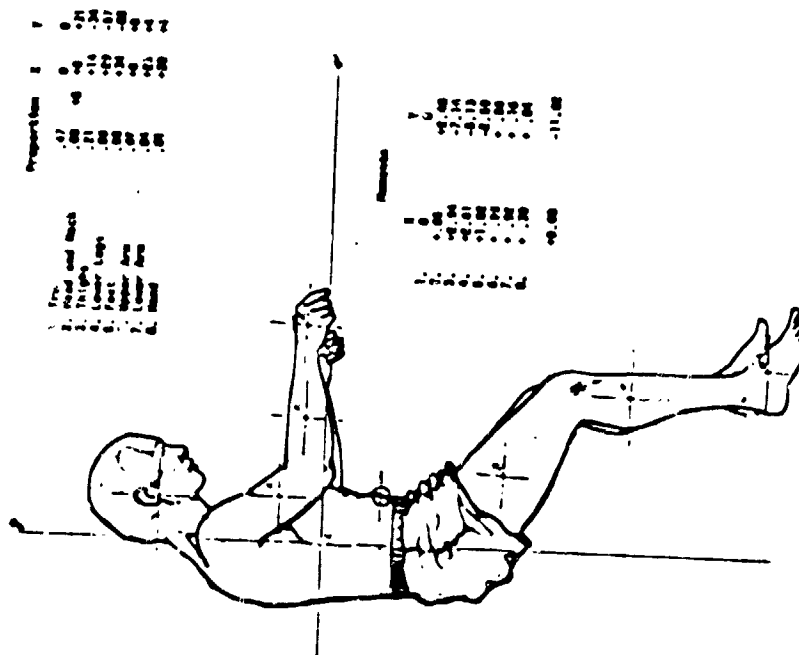


Space
Station

Center of Mass (Segmental Method)

NASA

SP-1111



NOTE: Proportions to fluid shift and duration of exposure to zero-g, the C.G. will move in the +y direction.



Space
Station

Neutral Body Posture Muscular Considerations

NASA
SP-1123



CHANGES IN POSTURE
OF POSTURE

4-116

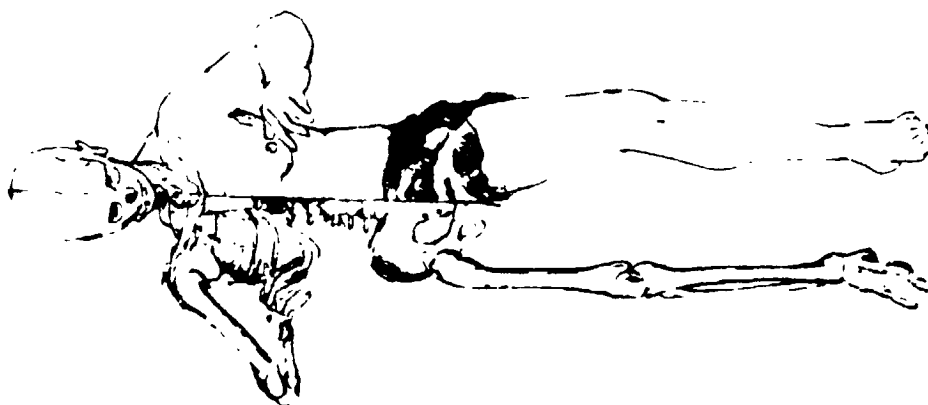
C-7



Space
Station

Neutral Body Posture/Skeleton

NASA
SS-1122



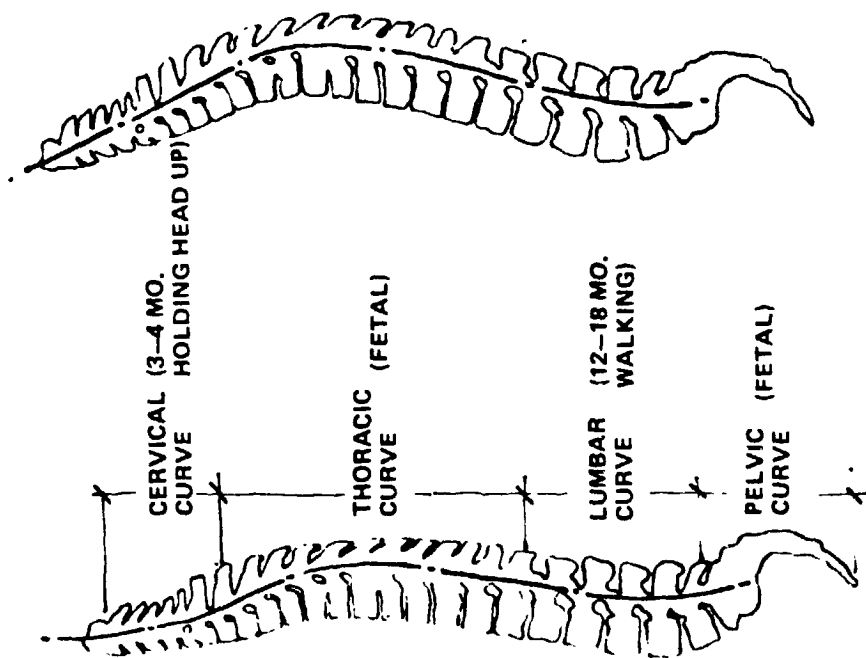
ORIGINAL QUALITY
OF POOR QUALITY



Space
Station

SS-1133

Zero-G Change to the Vertebrae Column

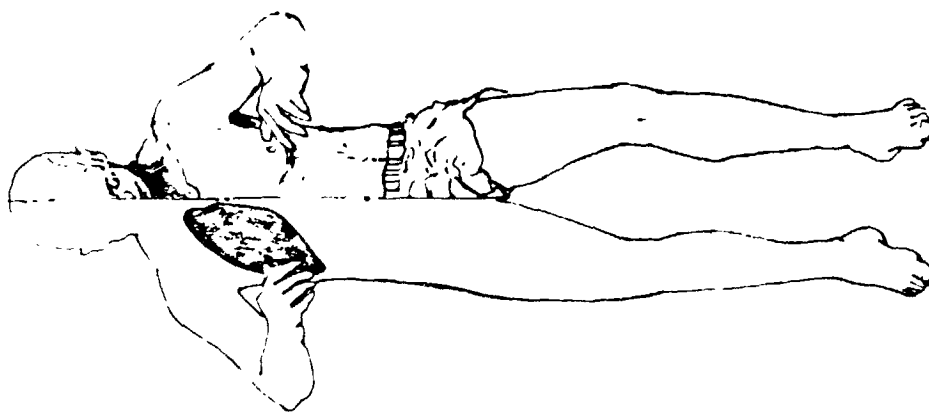




Space
Station

Neutral Body Posture/Pulmonary

NASA
SS-1127



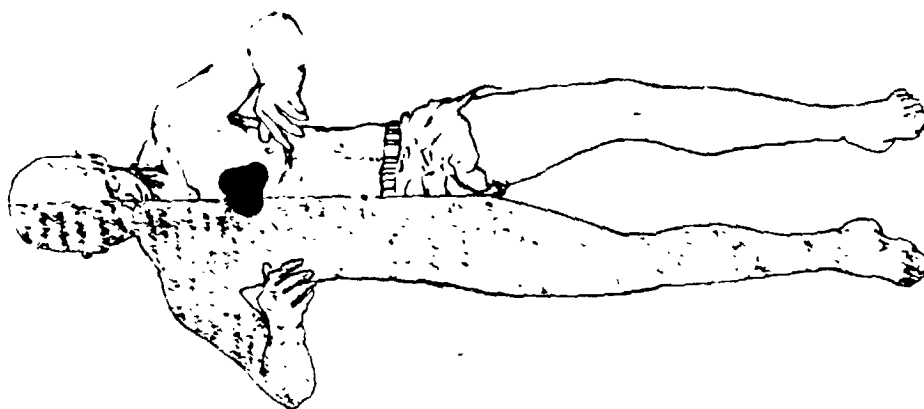
UNIT 1127
OF POOR QUALITY



Space
Station

Neutral Body Posture/Cardiovascular

NASA
SS-1130

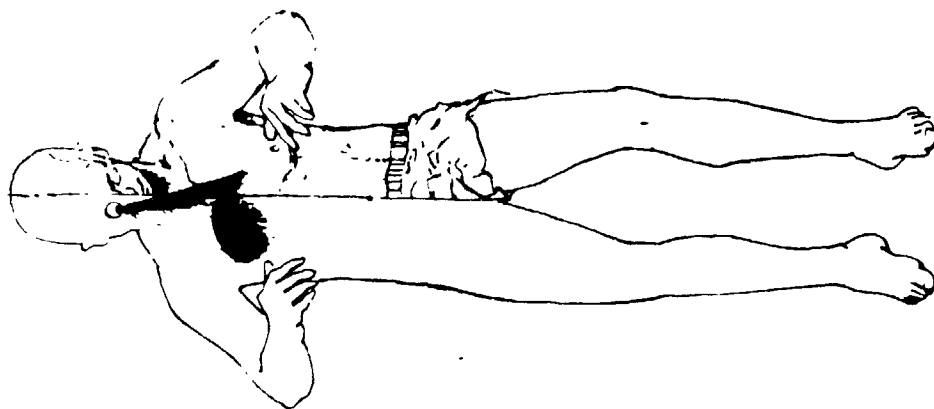




Space
Station

Neutral Body Posture/Vision

NASA
SS-1125



OFFICE OF
OF POSTURE

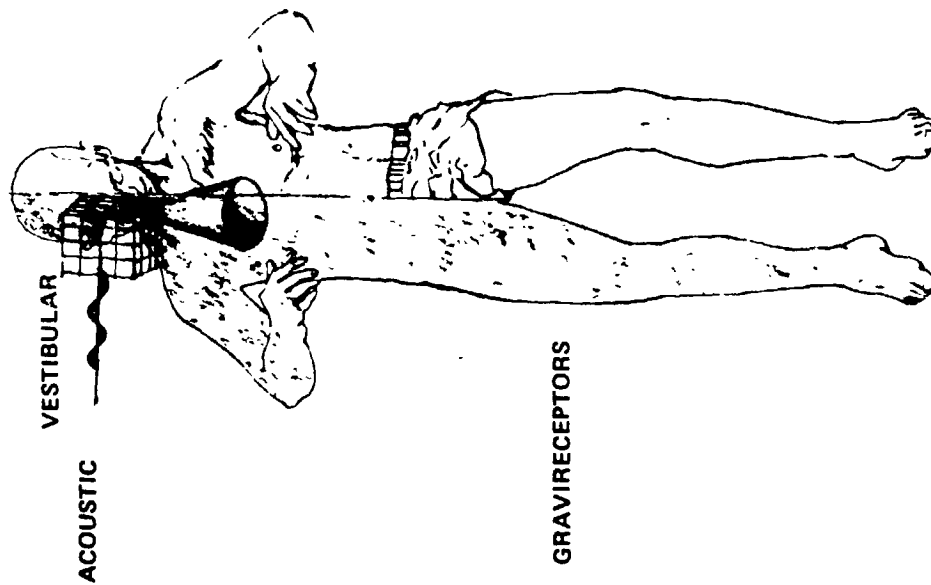


Space
Station

Neutral Body Posture/Orientation

NASA

SS-1131





Space
Station

Neutral Body Posture and EVA Suit Fit

NASA

SS-1126



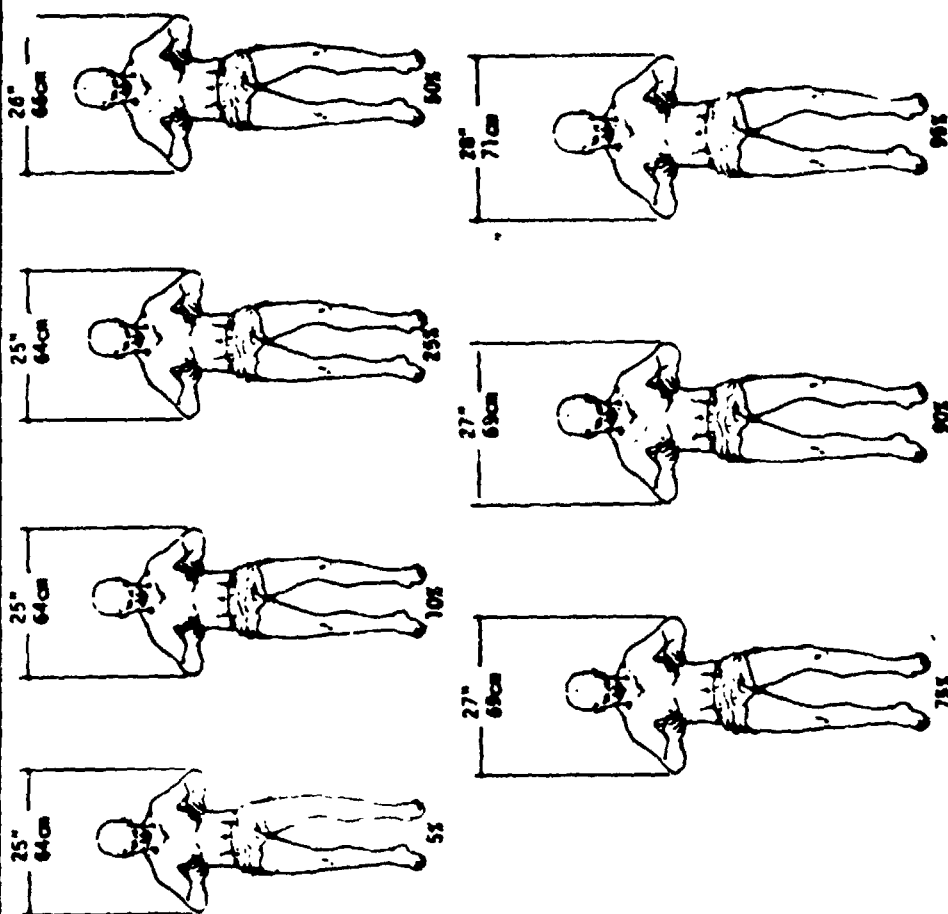
ORIGINAL FILED IN
OF POOR QUALITY



Space
Station

Nominal Dimensions of Male Neutral Body Posture Envelope by Percentile Groups Ventral Views

NASA
SP-11116

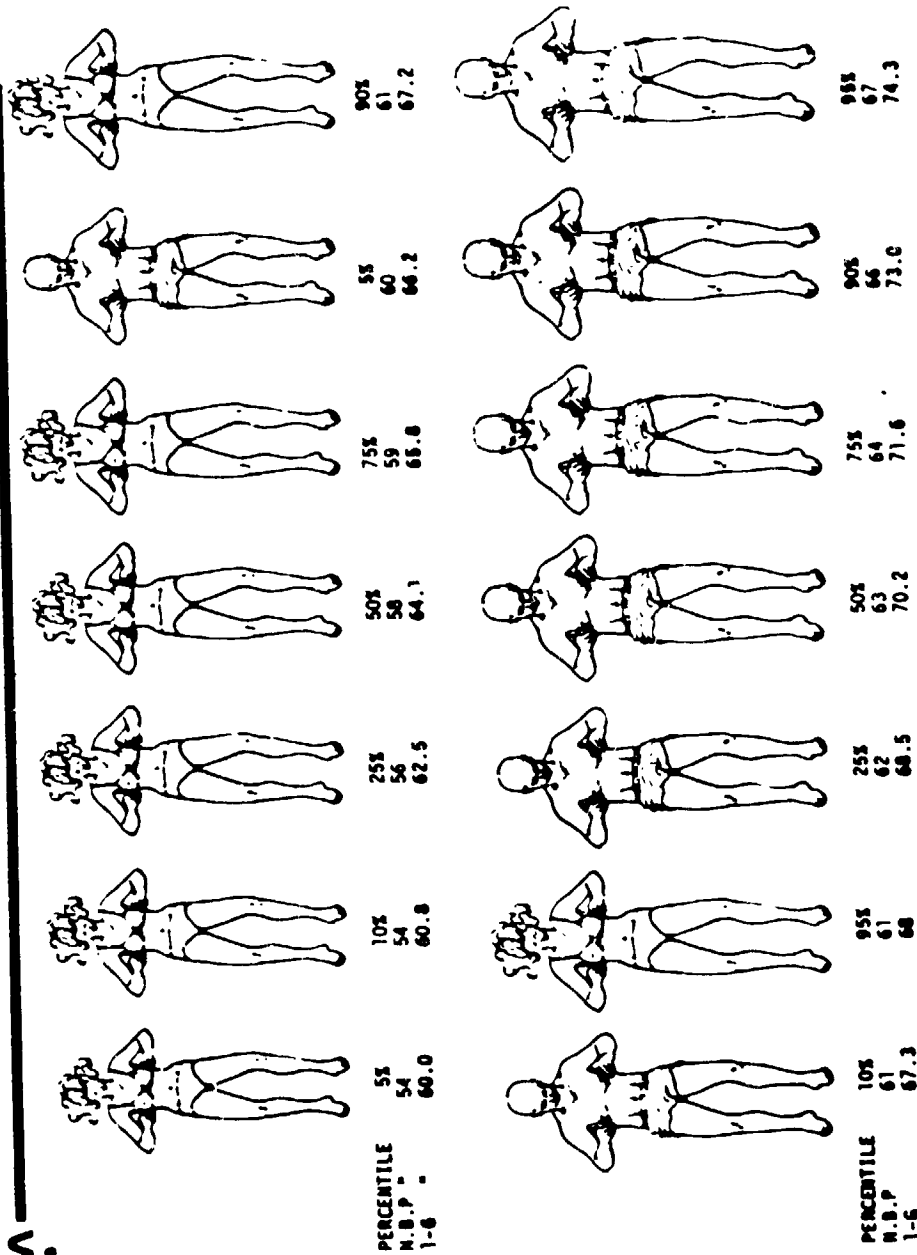




Space
Station

Male and Female N.B.P. Arranged by Height from Projected Astronaut Populations

NASA
DS-1116

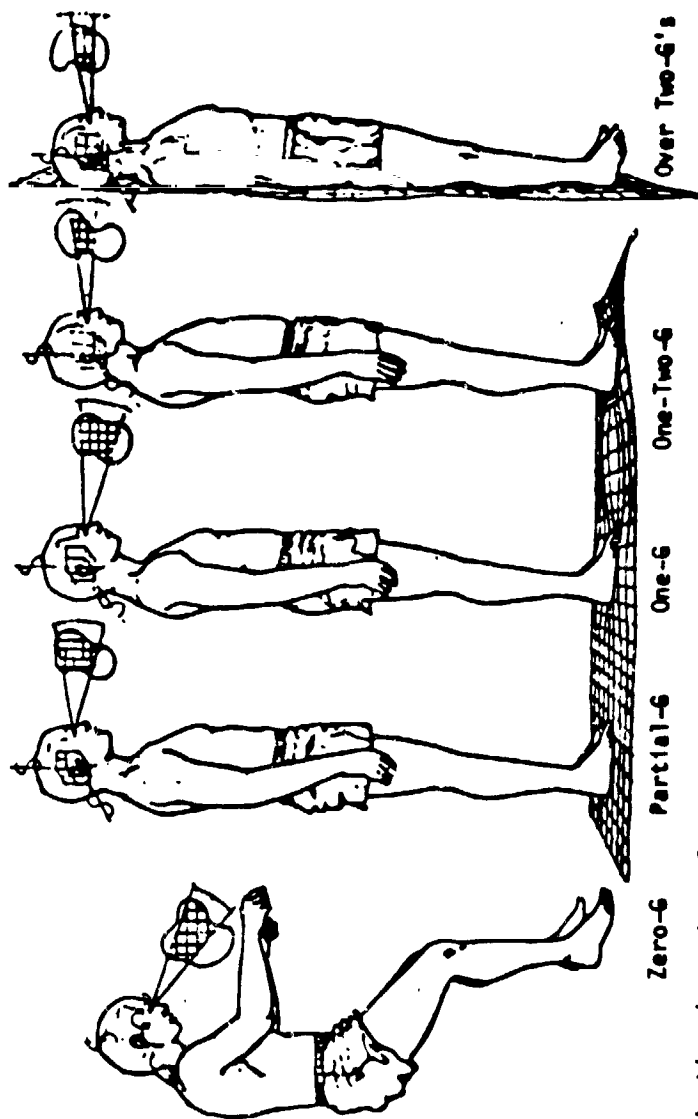




Space
Station

Comparative Orientation Analyzers

NASA
SP-1100



Over Two-G's

One-Two-G

One-G

Partial-G

Zero-G

Reduction in number of
afferent impulses used
for orientation.

1. No otolith functions.
2. No cutaneous (proprioceptive--must be imposed).

Tunnel Vision
reduces field
of sight.

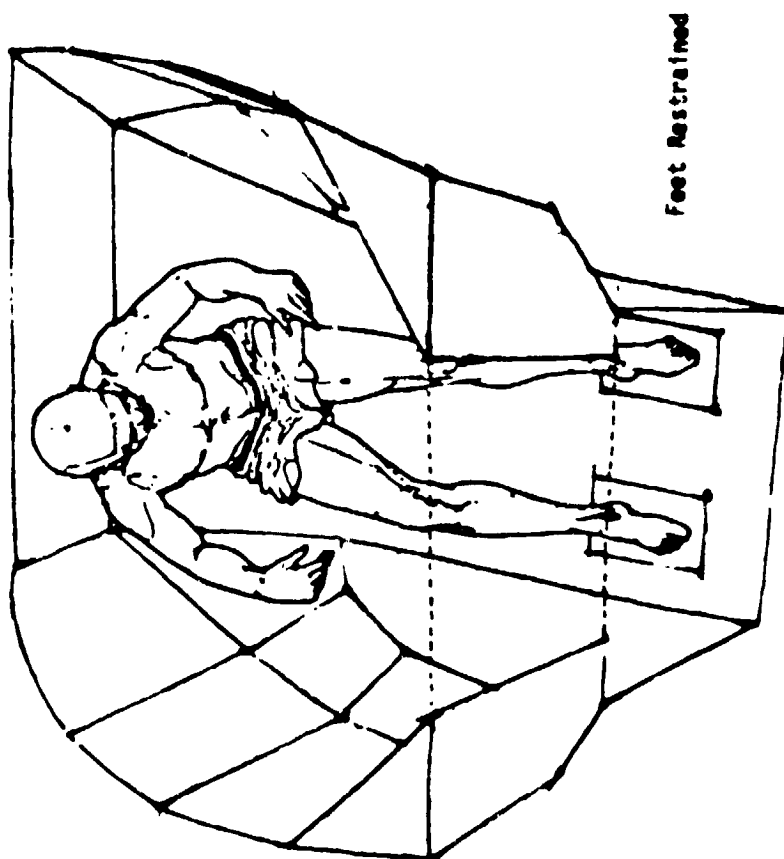


Space
Station

Work Station Diagram for the Dynamic Zero-G Envelope

NASA
D-117

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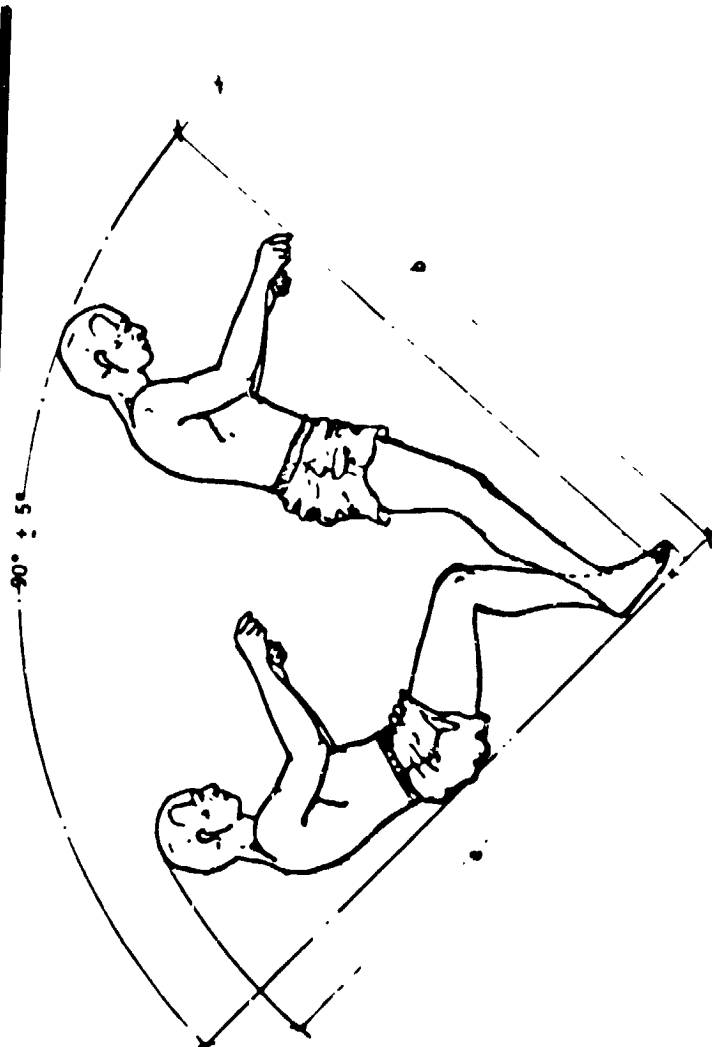




Space
Station

Dynamic Zero-G Envelope

NASA
SP-1700



NOMINAL LIMITS OF MOVEMENT FROM
RESTRAINED FOOT POSITION

	MALE							FEMALE						
	5%	10%	25%	50%	75%	90%	95%	5%	10%	25%	50%	75%	90%	95%
a"	58	59	60	62	75	64	65	53	53	55	57	58	59	61
b"	65	66	67	69	70	71	72	59	59	61	63	64	66	67

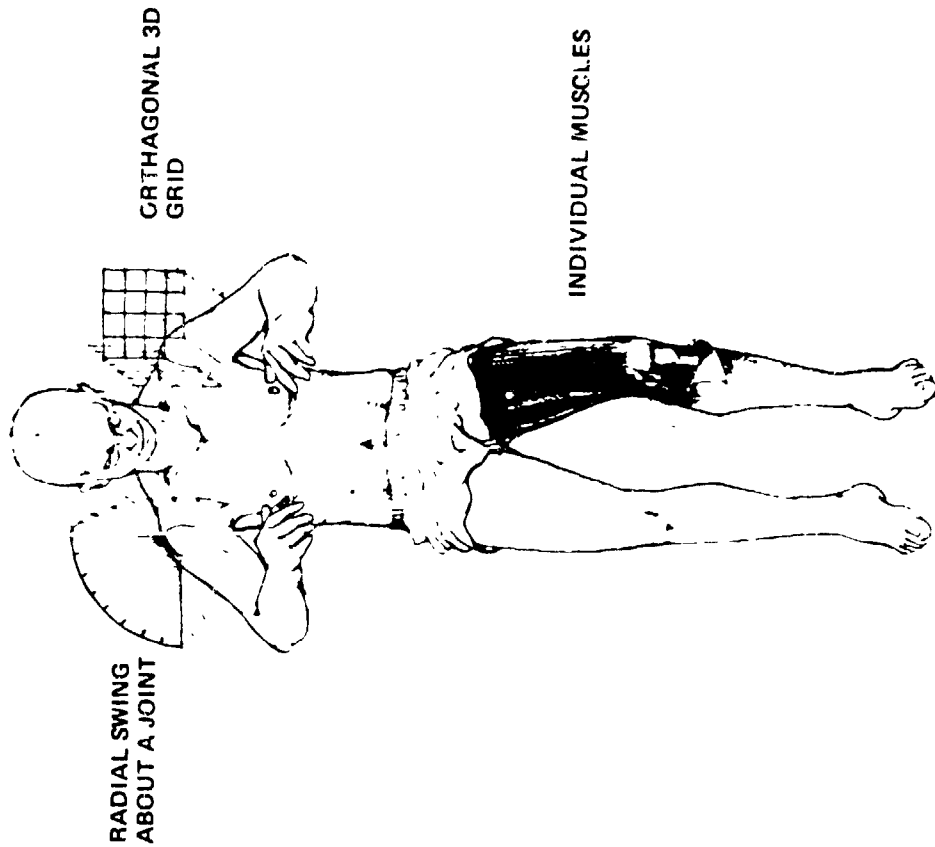


Space
Station

Quantifying Work from Neutral Body Datum

NASA

SS-1132





Space
Station

Zero-G Activity Analysis (Donning and Doffing IVA Wear)

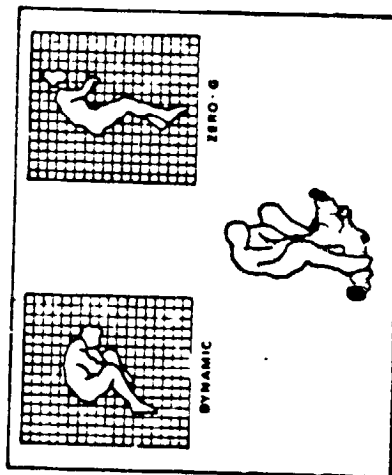
NASA
SP-100

Profile, unit extreme
posture exhibited for
that activity

Normal view - 2
representation of
activity

Body description by
major muscle groups

Work diagram - graphic portrayal
of individual muscle work superim-
posed on H.B.P.



Desired restraint
necessary for effi-
cient performance.

Heat produced by
activity

Quantity of O₂ con-
sumed

Quantity of CO₂ pro-
duced

Heat produced by
equipment and other
crewmembers within
the immediate vicinity

No. of times the
activity is performed
in 24 hour period

Orientation required
for that activity

MUSCLE	WORK	TIME
Head neck		
Shoulder		
Back		
Stomach		
Glute		
Upper Arms		
Lower Arms		
Brake		
Buttocks		
Upper Leg		
Lower Leg		
Ankle-foot		

RESTRAINT	STUN BODY	ORIGIN	CARDIO EXHAUST	TUM CENTRAL	FREQUENCY	ORIENTATION
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Time each muscle group is working						

Work exerted by muscle
groups for that activity -
calibration based on
measurement through cybox
isokinetic dynamometer, infrared
photography, EMG or photogrammetry



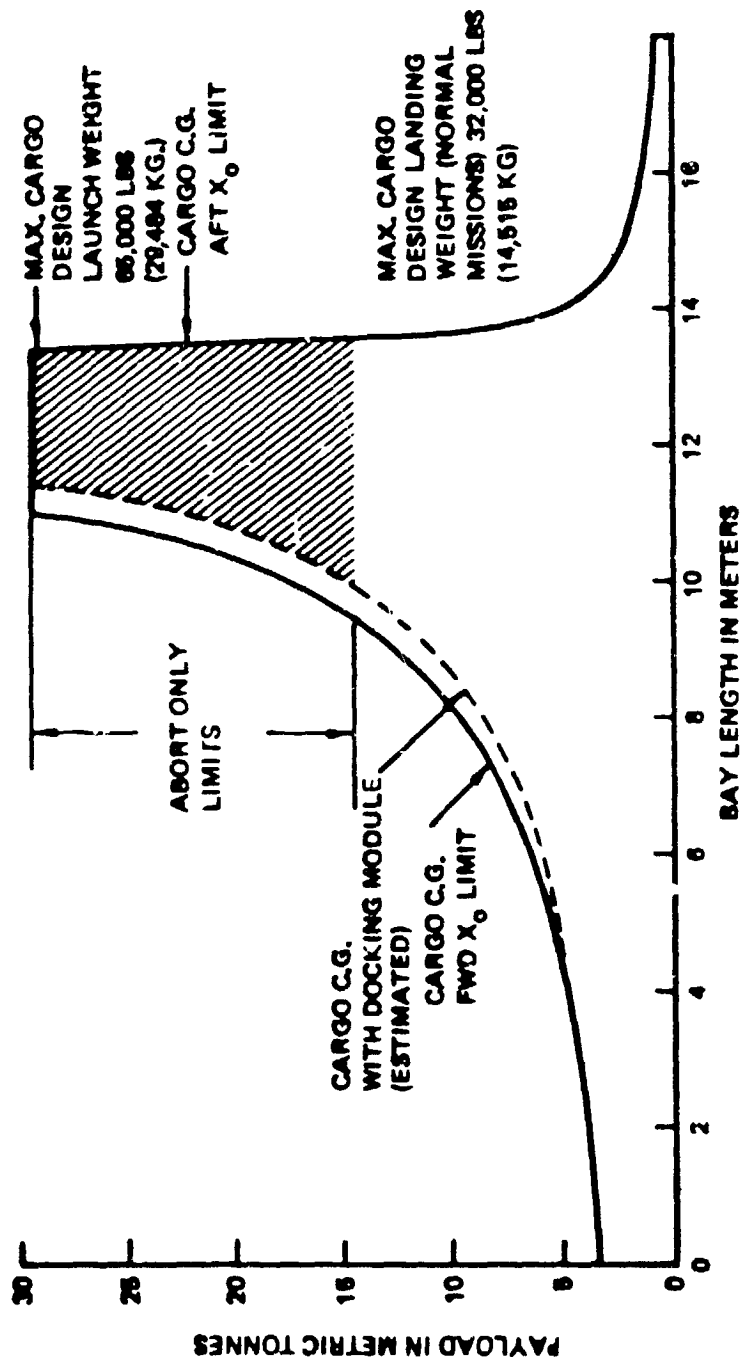
Space
Station

Shuttle Center of Gravity

NASA

SP-004

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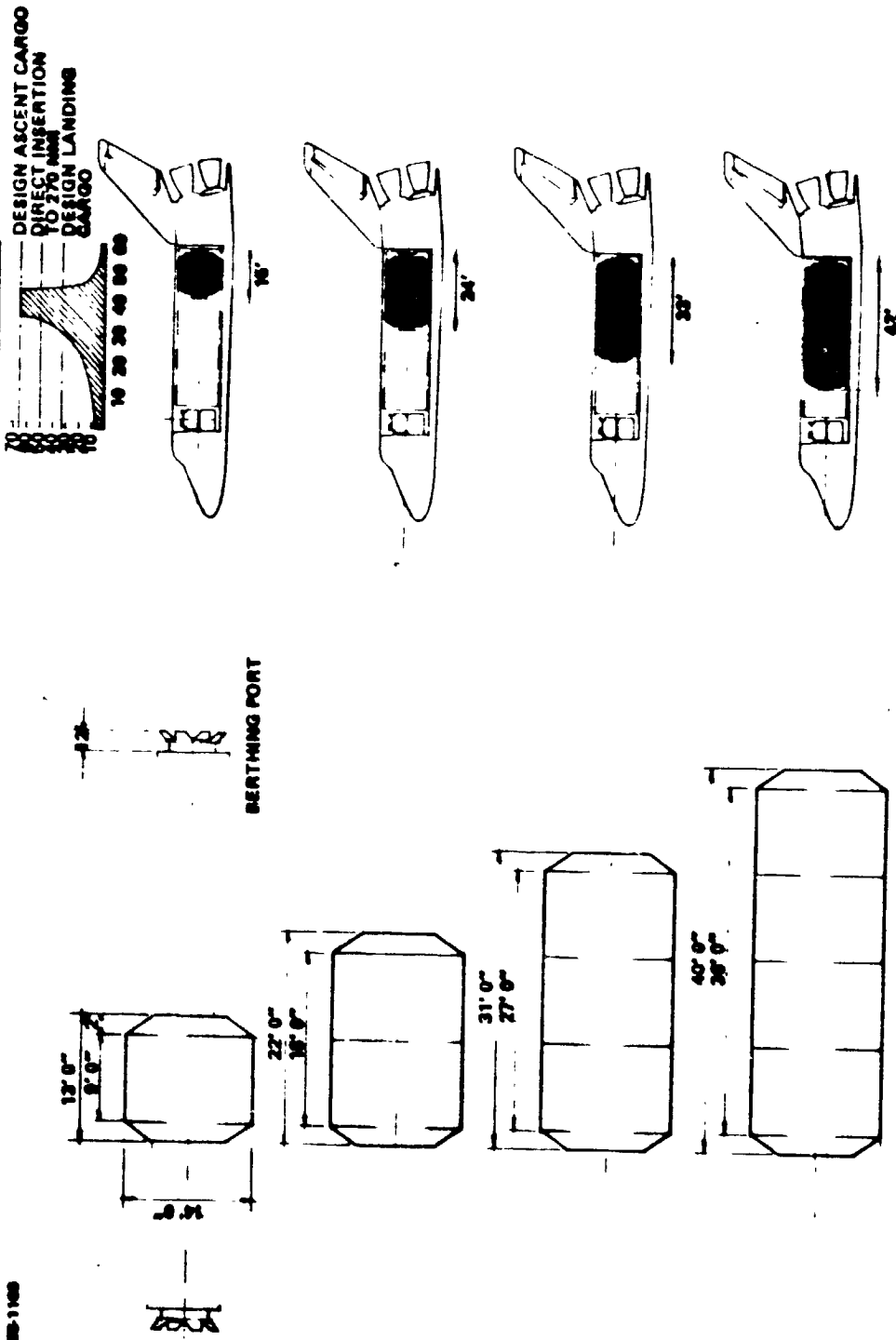




Space
Station

Module Length

NASA
SS-1102



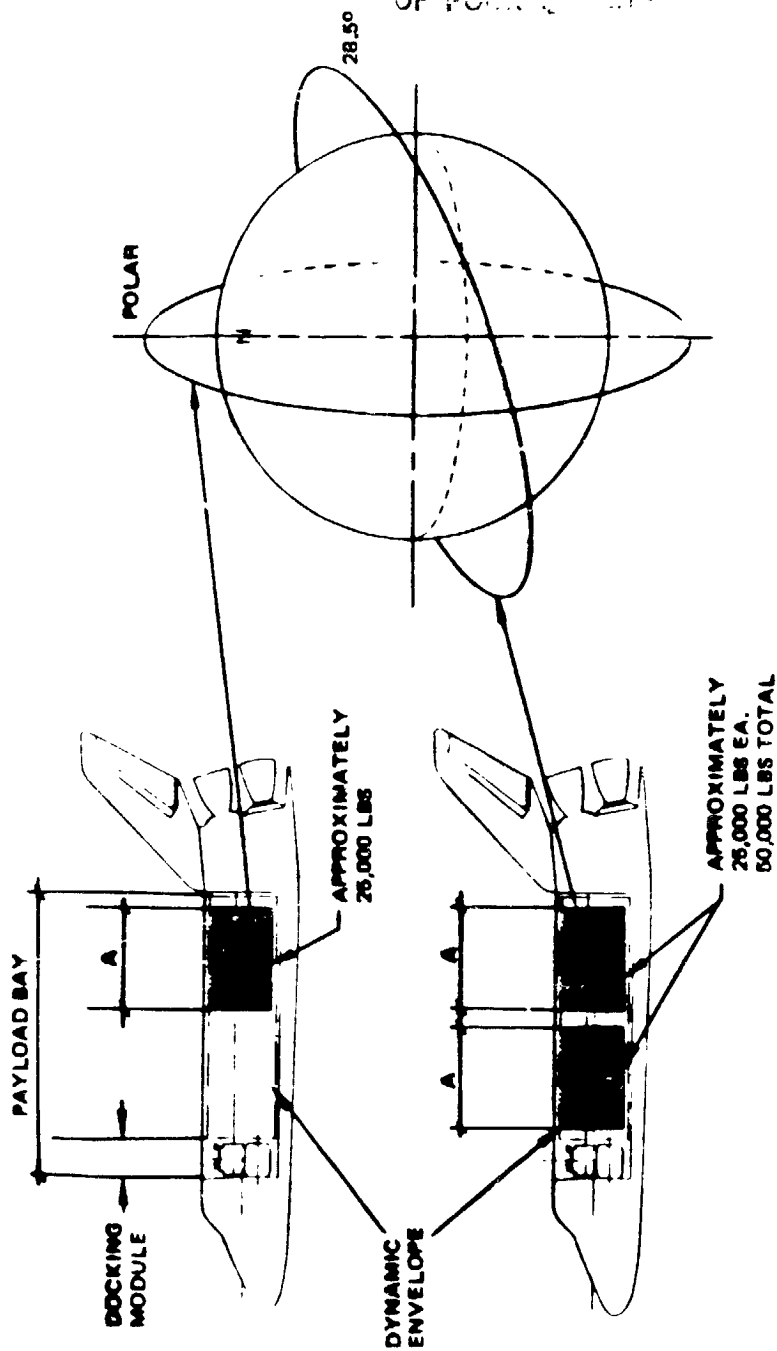


Space
Station.

Module Sizing Rationale Incremental Architecture

NASA

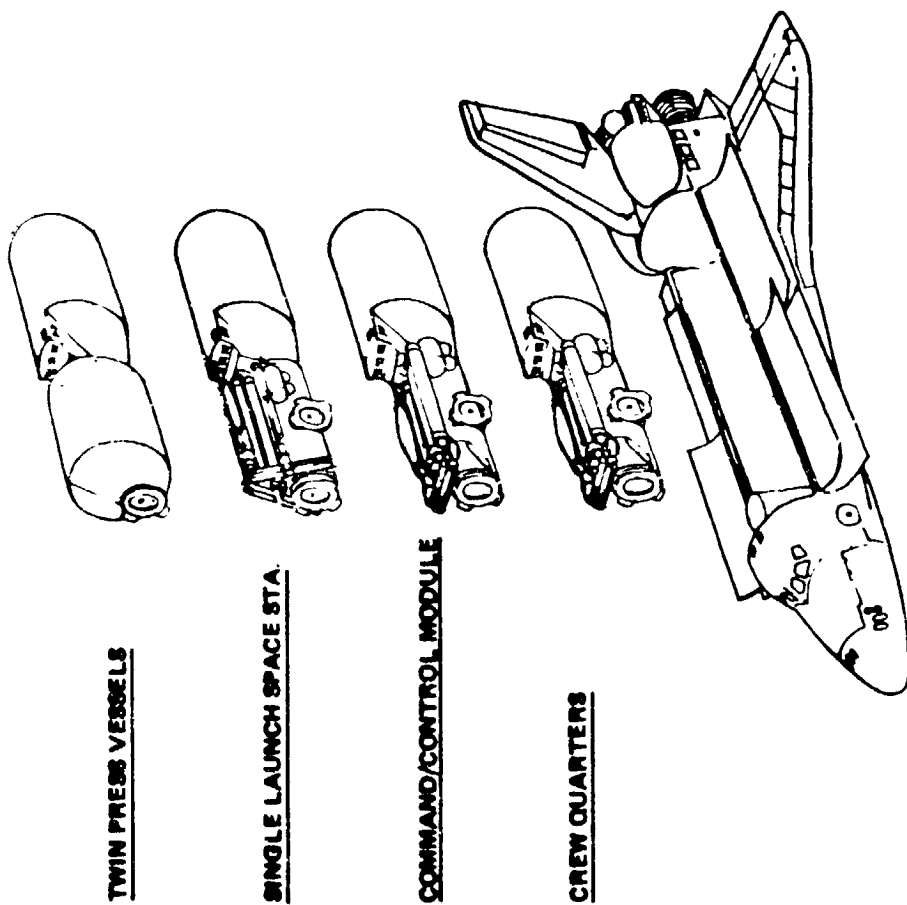
SP-400



**SPACE
OPERATIONS
CENTER**

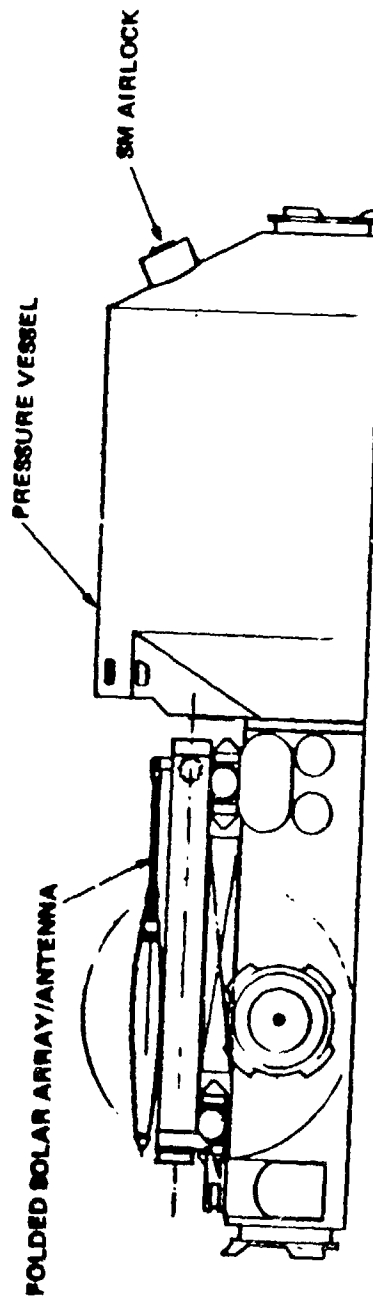
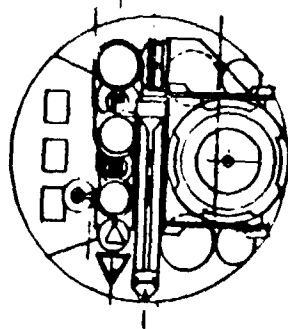
**BOEING PROPRIETARY
Delivery Options**

NSA
SOC-1404



**SPACE
OPERATIONS
CENTER** **External View Alternative Module**

NASA
SOC-1476

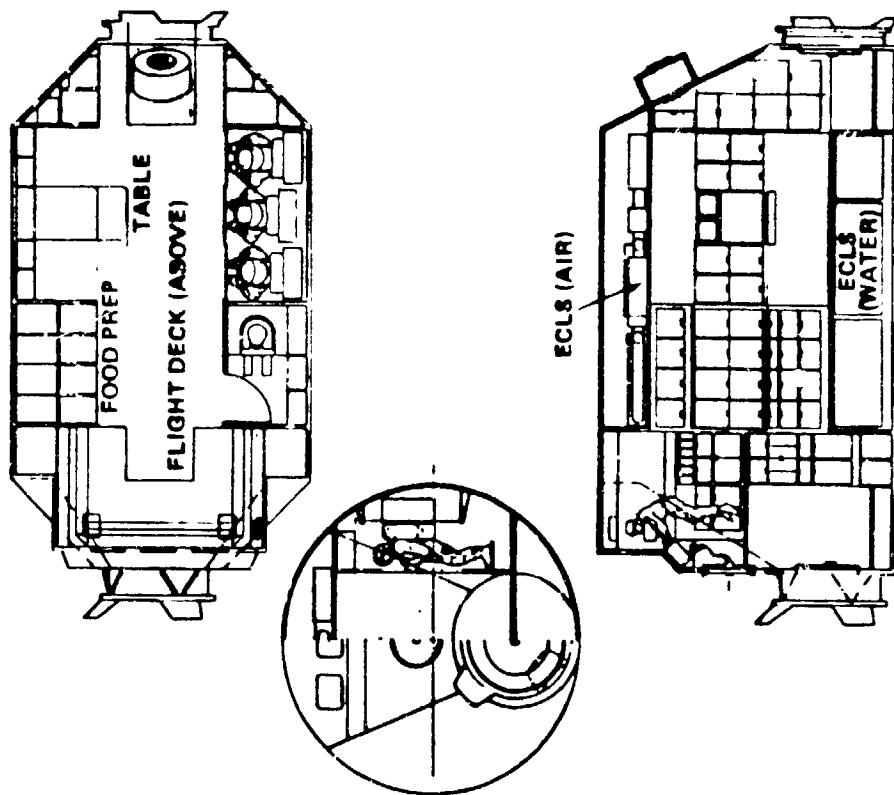


4-135

**SPACE
OPERATIONS
CENTER**

Command/Control Module

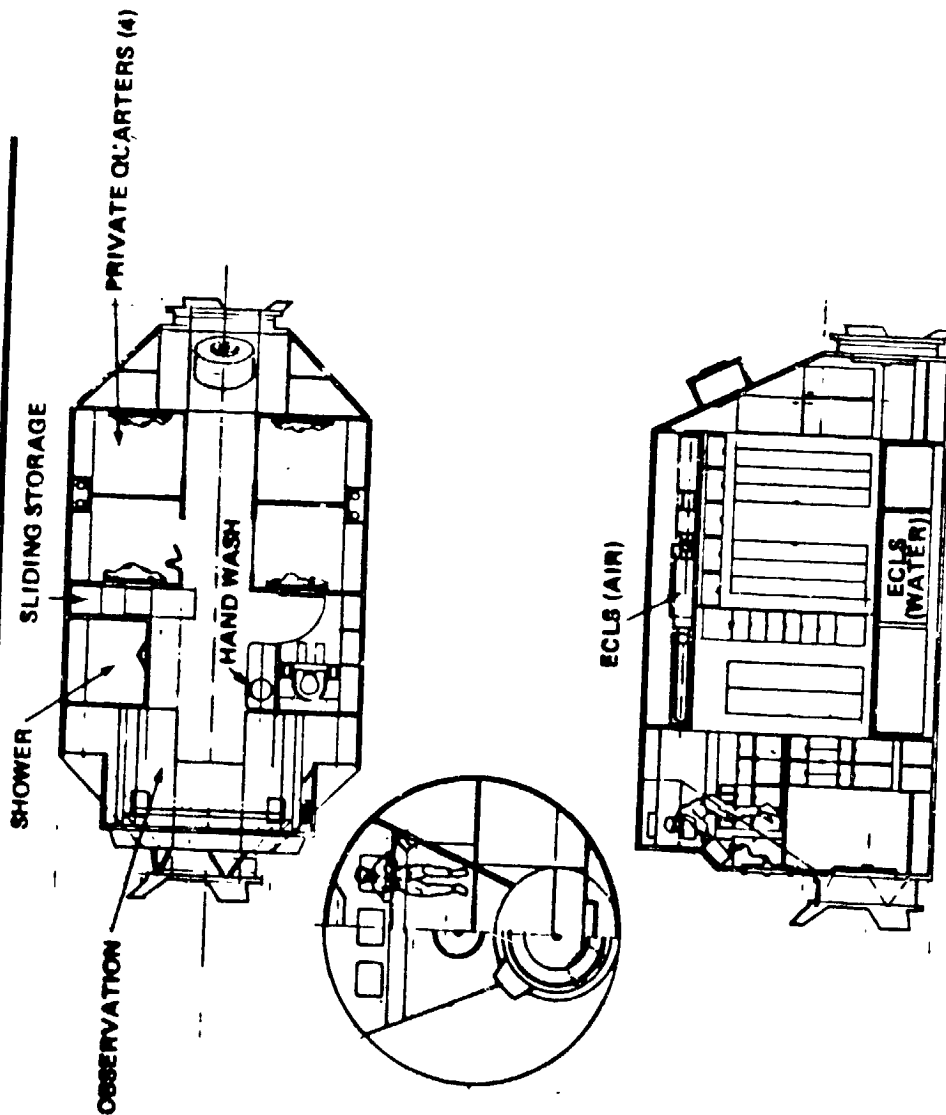
NASA
SOC-1467



**SPACE
OPERATIONS
CENTER**

Crew Quarters Module

NASA
SOC-1463

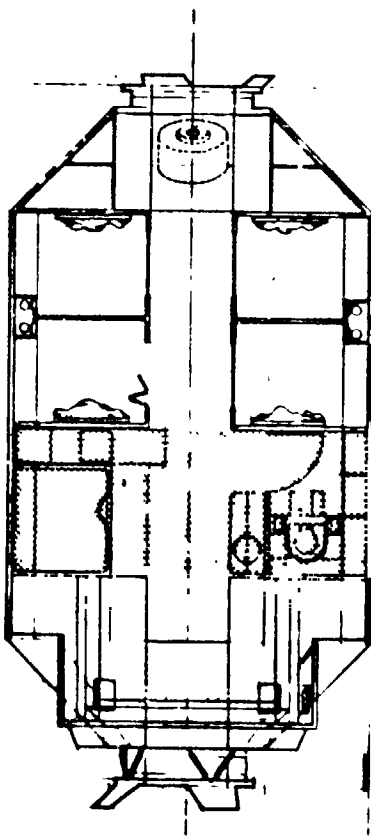


ORIGINAL PART OF
OF POOR QUALITY.

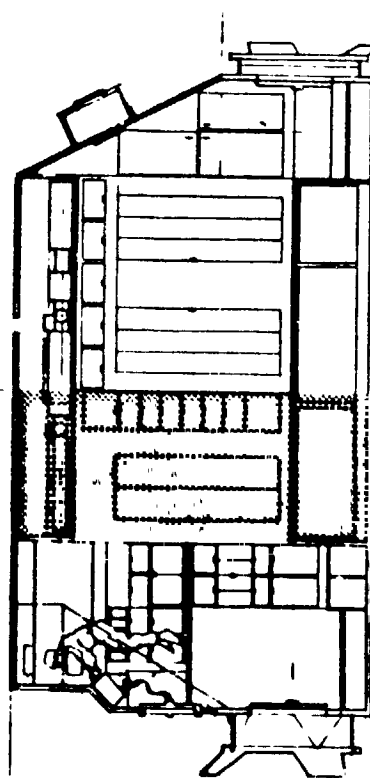
**SPACE
OPERATIONS
CENTER**

Crew Quarters Mechanical Zone

NASA
SOC-1434



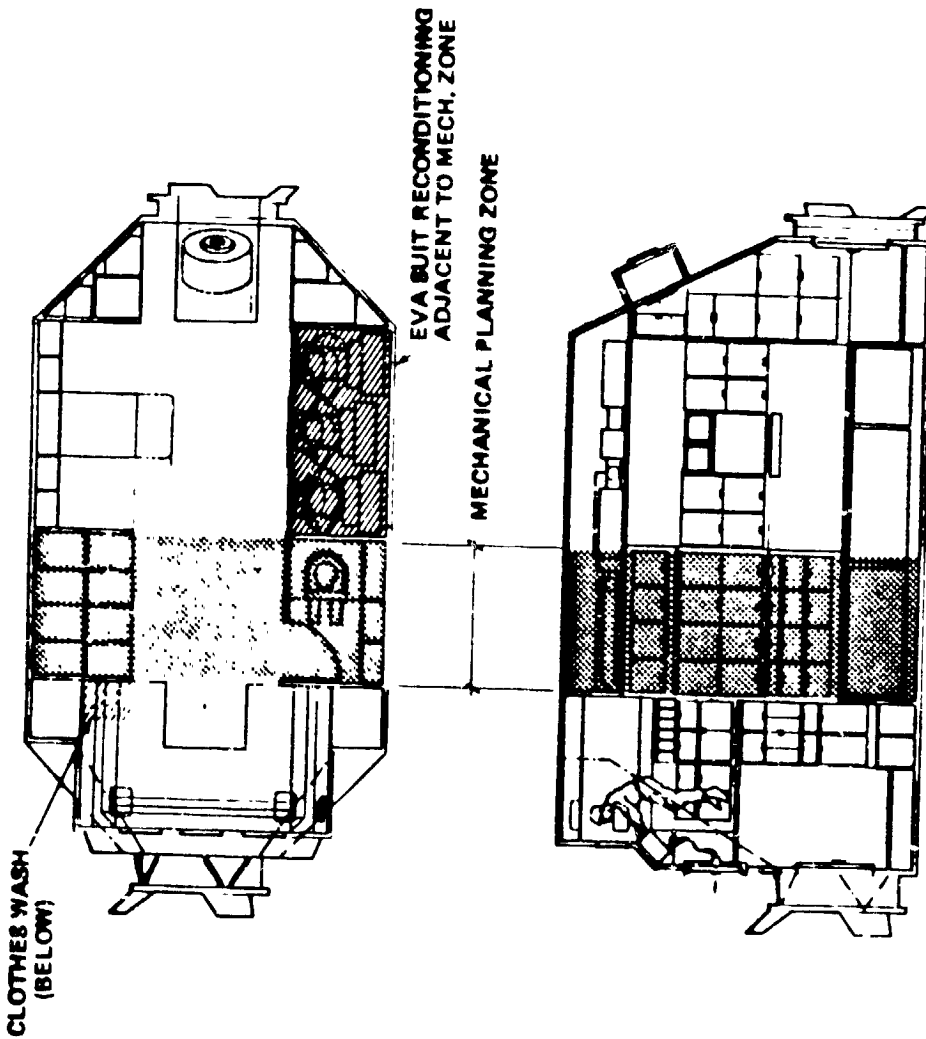
MECHANICAL PLANNING ZONE



**SPACE
OPERATIONS
CENTER**

Command/Control Mechanical Zone

NASA
SOC 1479

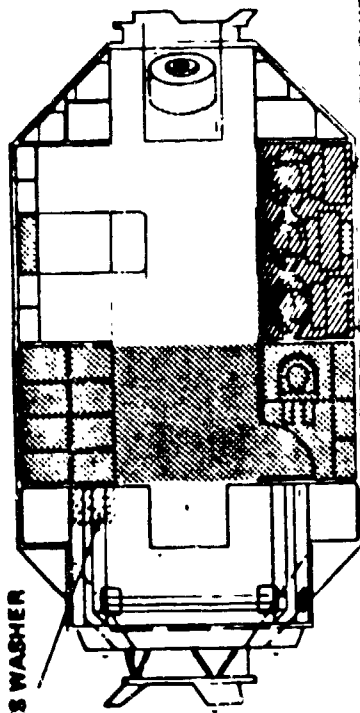


**SPACE
OPERATIONS
CENTER**

**Comparative Mechanical Zone
Placement**

NASA
DOC 1433

CLOTHES WASHER
(BELOW)



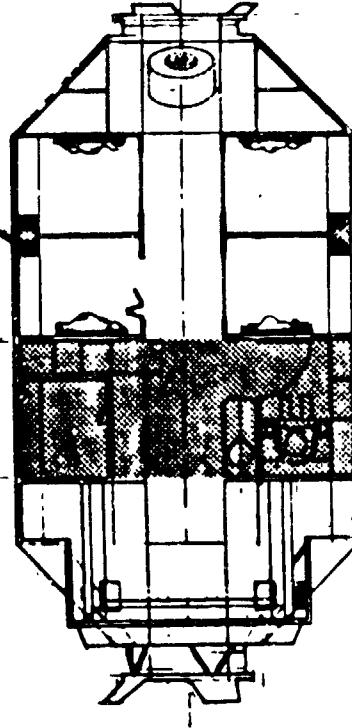
COMMAND/CONTROL

EVA SUIT RECONDITIONING
ADJACENT TO MECH. ZONE

MECHANICAL PLANNING ZONE





VERTICAL CHASE

CREW QUARTERS



Adjacency Matrix

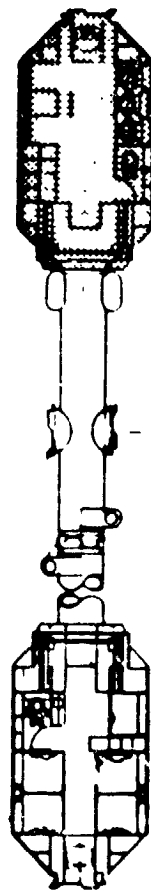
ORIGINAL OF POOR QUALITY

	CLOSE PROXIMITY
	MODERATE PROXIMITY
	SEPARATION
	NO PREFERENCE

**SPACE
OPERATIONS
CENTER**

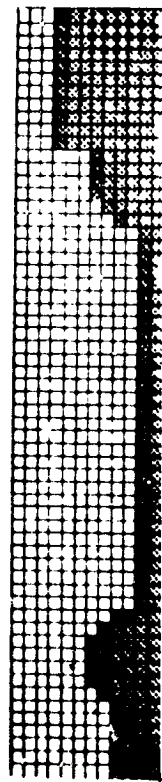
Open Space, Command/Control Module

NASA
SOC 1430



CREW QUARTERS

COMMAND/CONTROL



OPEN SPACE

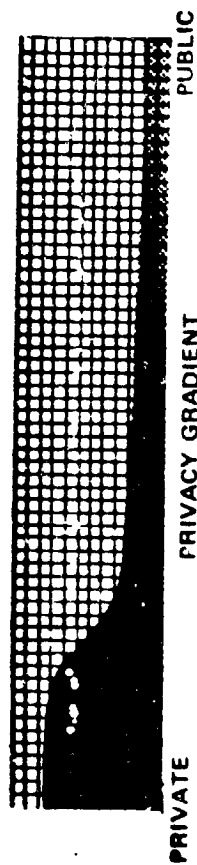
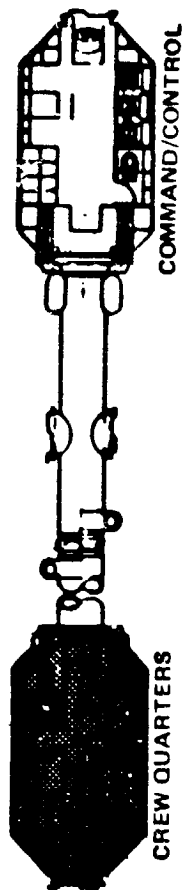


COMMAND/CONTROL MODULE

**SPACE
OPERATIONS
CENTER**

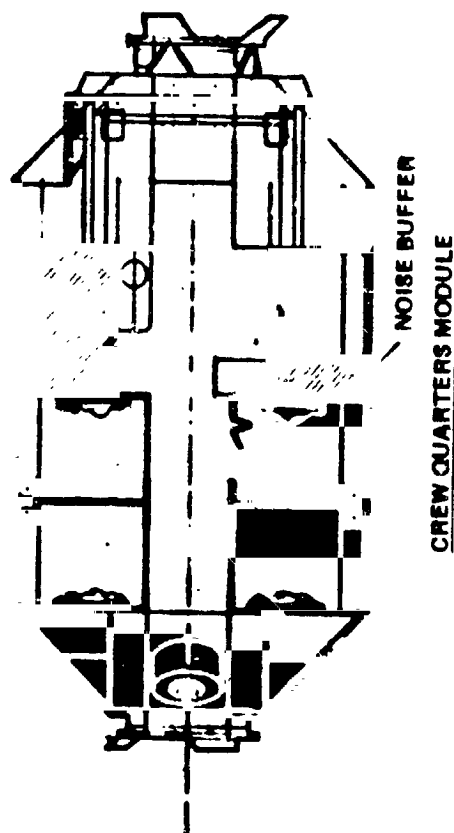
Privacy Gradient

NSA
SOC-1436



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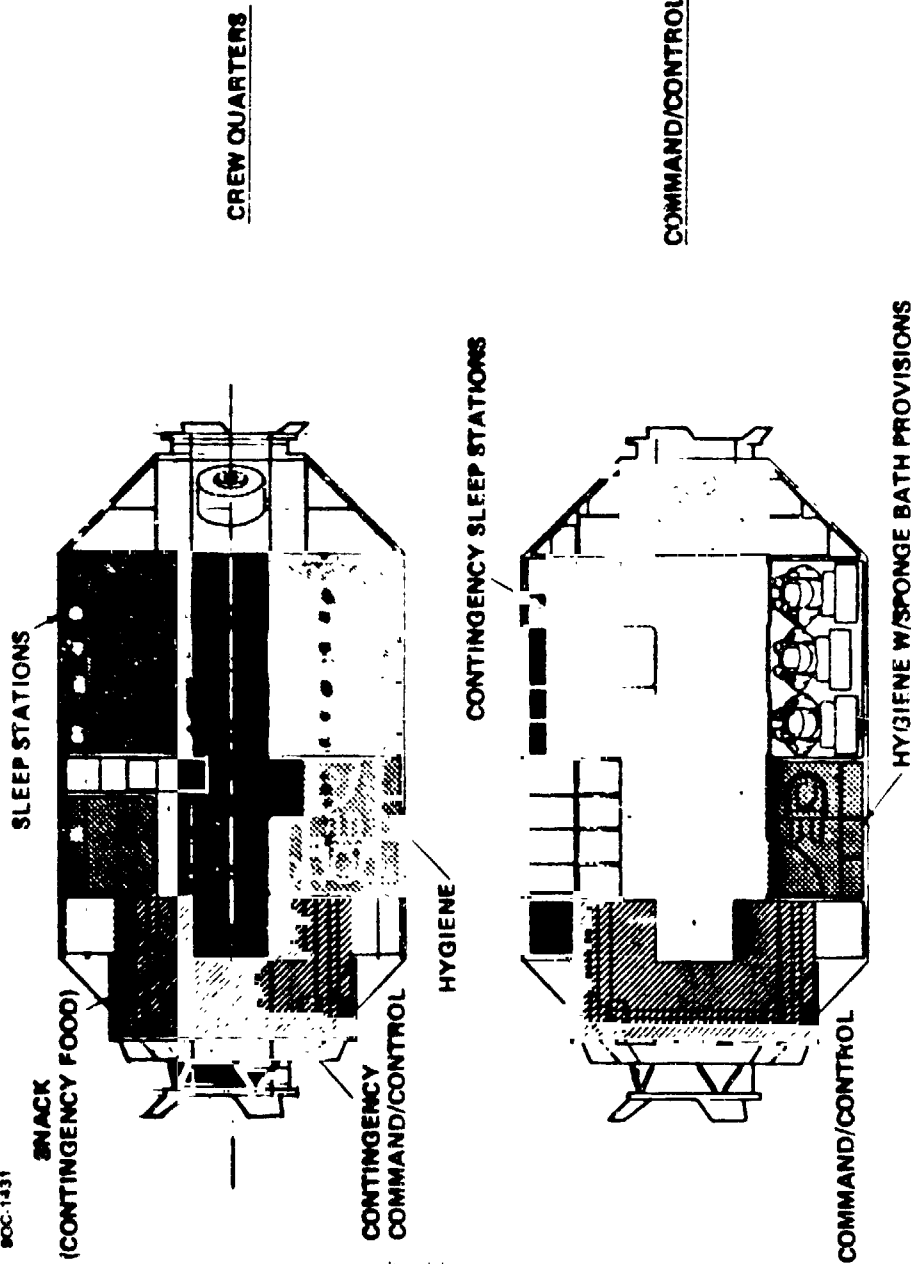
4-143



SPACE OPERATIONS CENTER

Redundancy

NASA
DOC-1431



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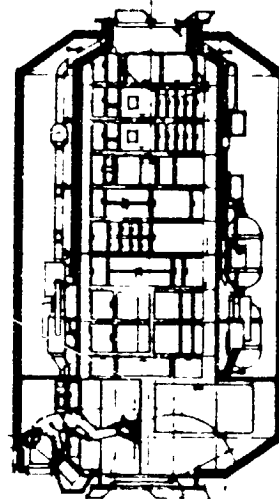
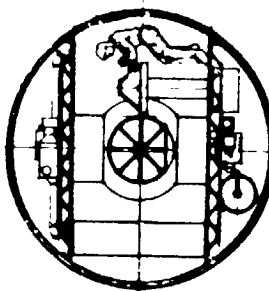
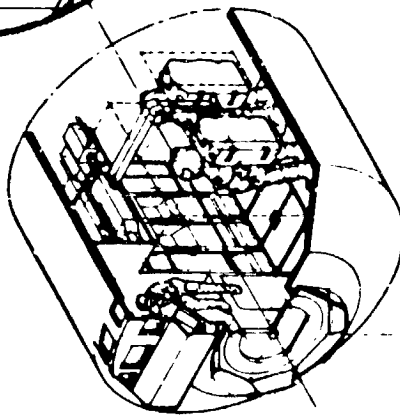
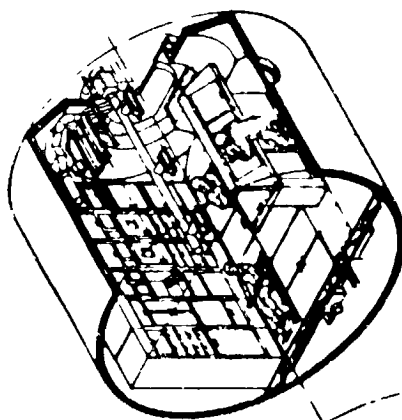


Space
Station

Space Station Common Module (Active)

NASA
SP-1108

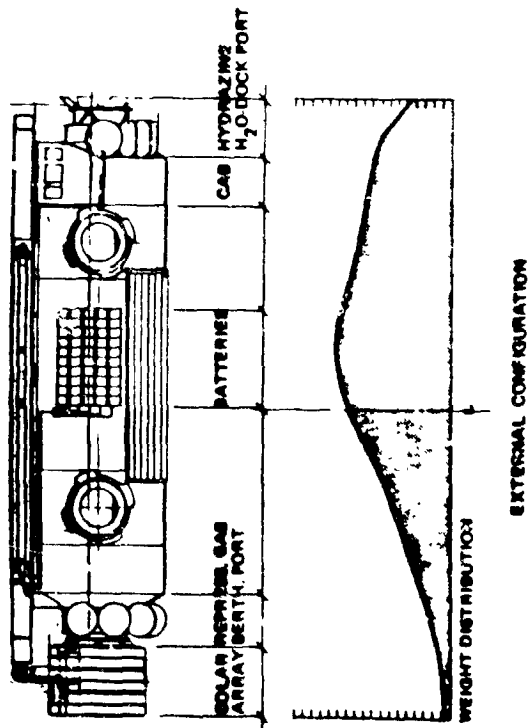
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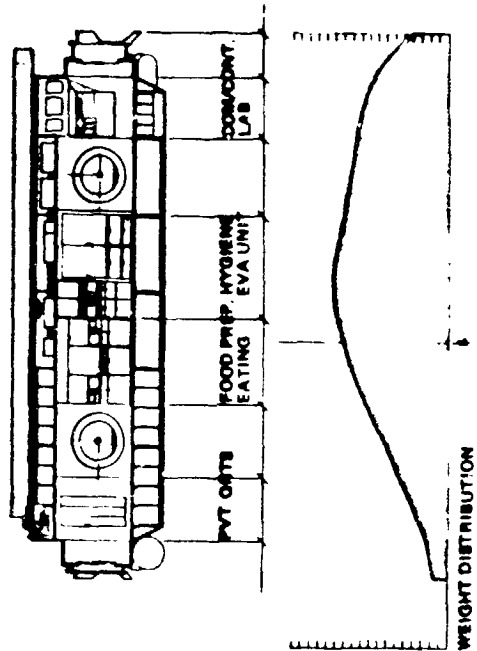
LARGE SPACE SYSTEMS

L32-004

Habitable Service Module Weight Distribution

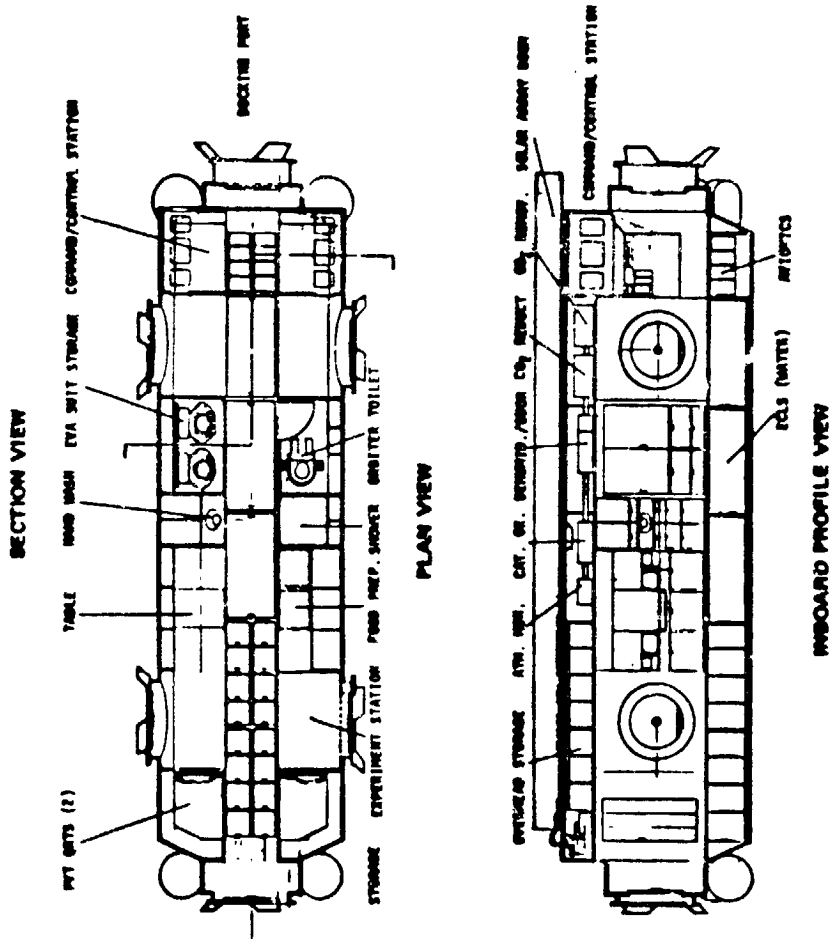


EXTERNAL CONFIGURATION



INTERNAL LAYOUT

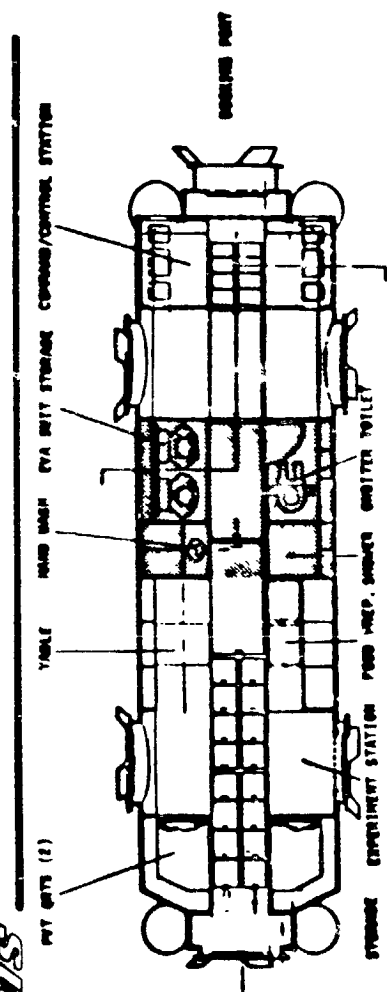
Habitable Service Module, Interior Layout (2 Man Configuration)



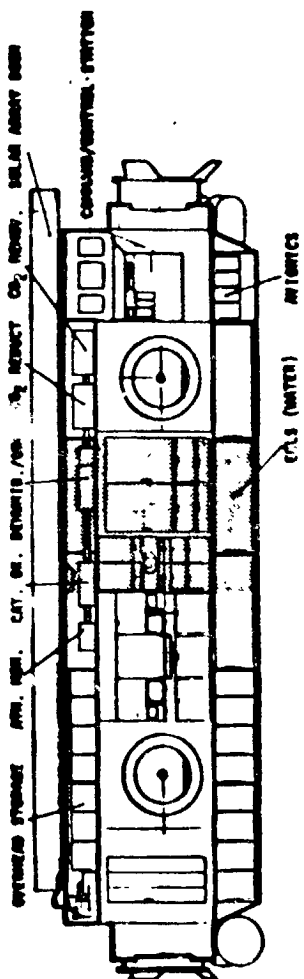
**LARGE
SPACE
SYSTEMS**

LSS-030

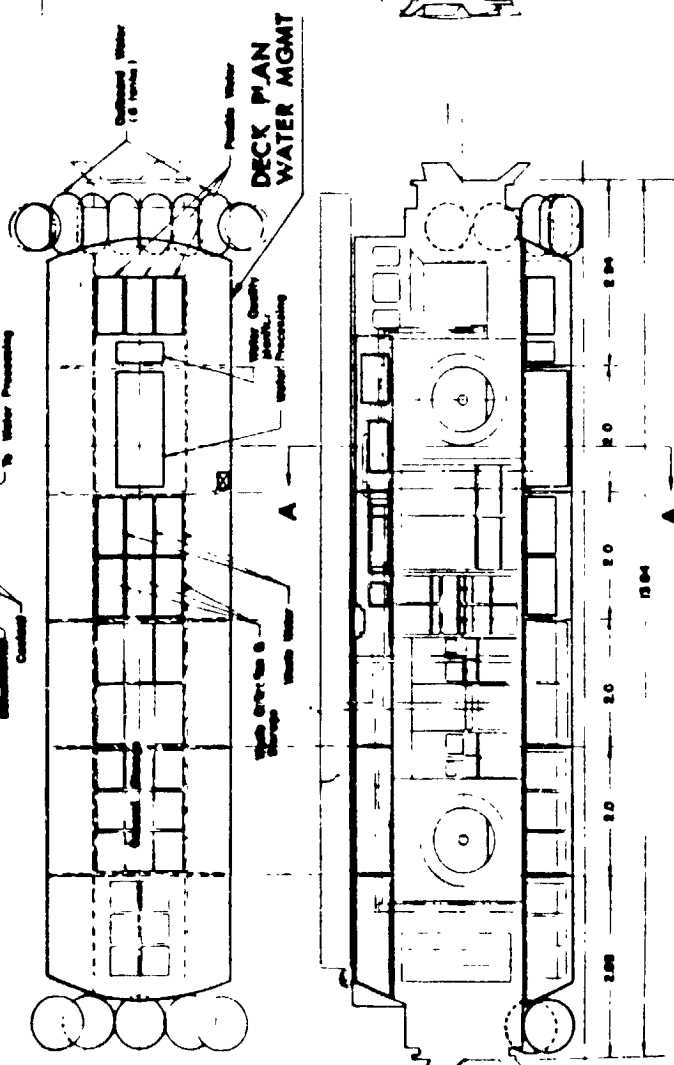
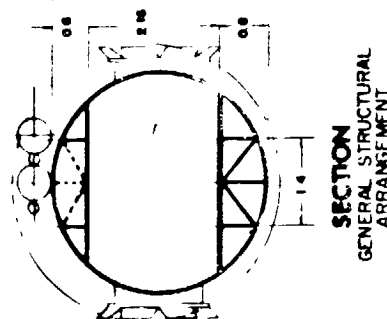
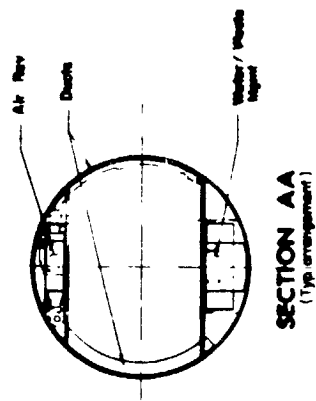
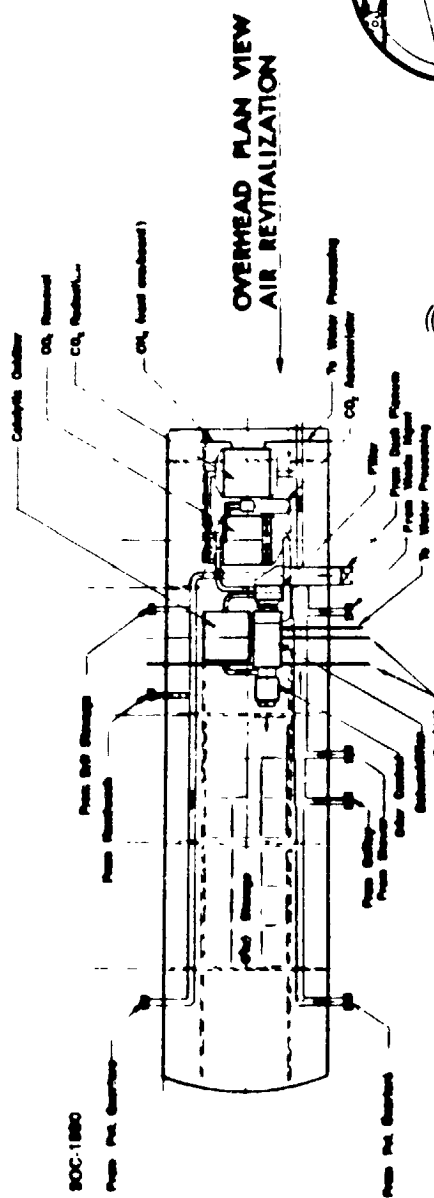
Hygiene/EVA Suit Storage Zone



PLAN VIEW



INBOARD PROFILE VIEW

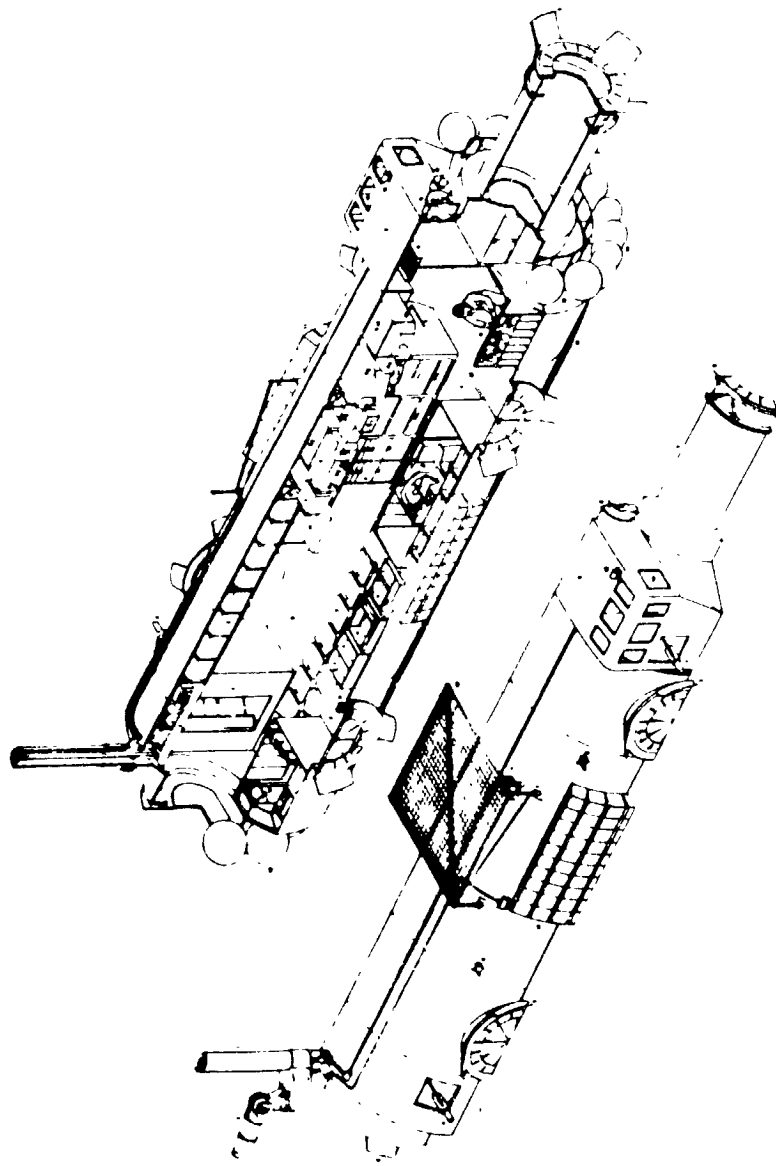




Space
Station

Hybrid Module/Interior-Exterior

NASA

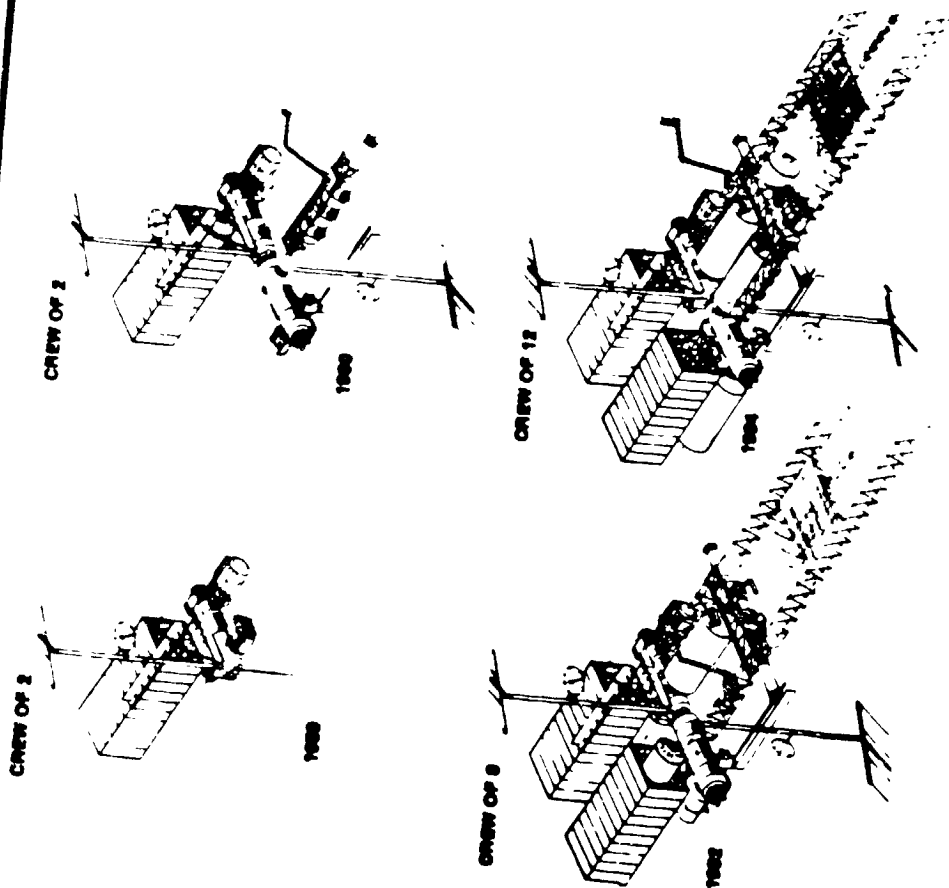


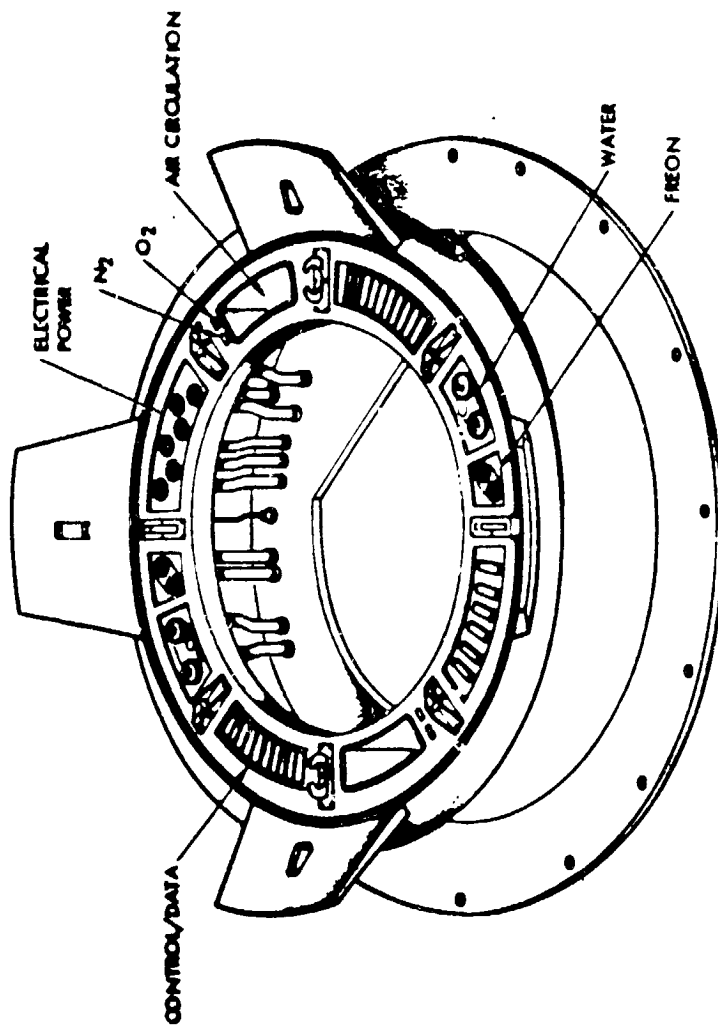
4-150

**LARGE
SPACE
SYSTEMS**

LS-044

Mission Derived Build-up Sequence





Space Station Module to Module Interface

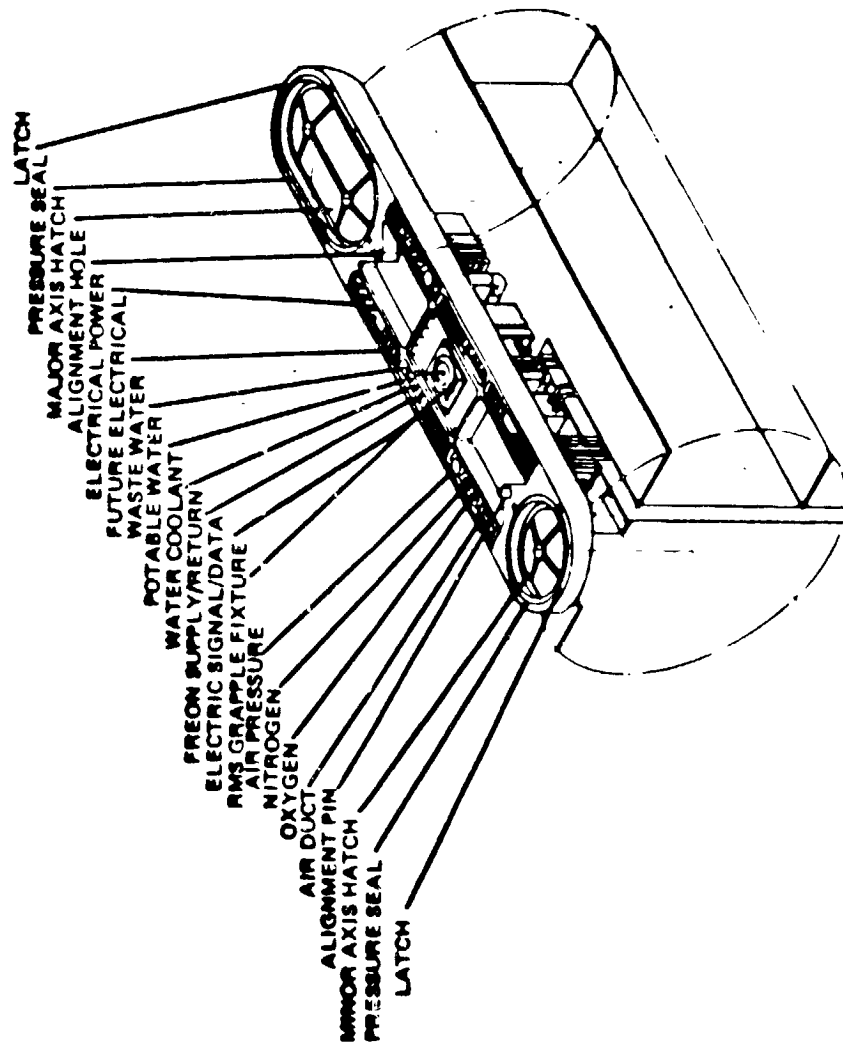


Space
Station

Berthing Interface Unified Architecture

NASA

88-708



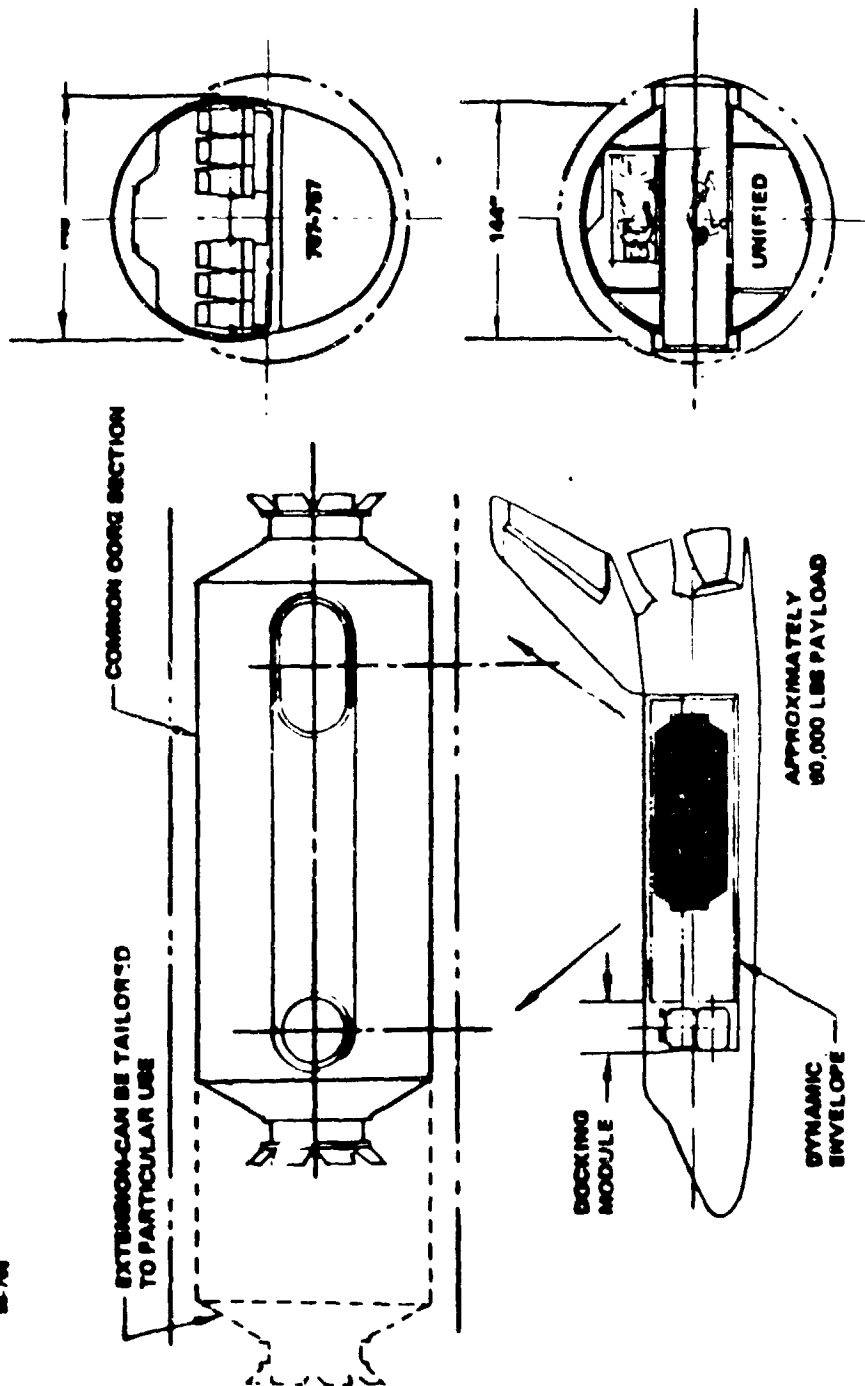


Space
Station

Module Sizing Rationale Unified Architecture

NASA

SS-740

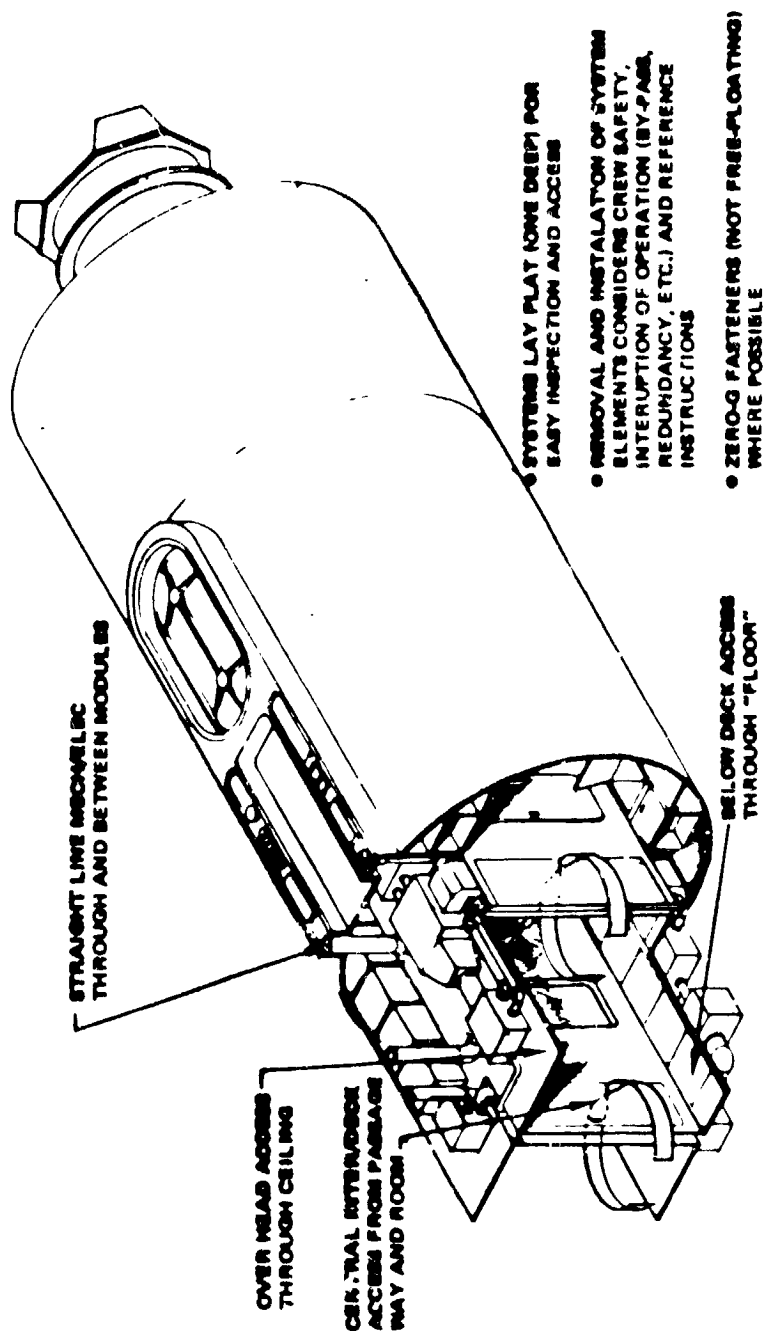




Space
Station

On-Orbit Subsystem Accessibility

NASA
SP-746

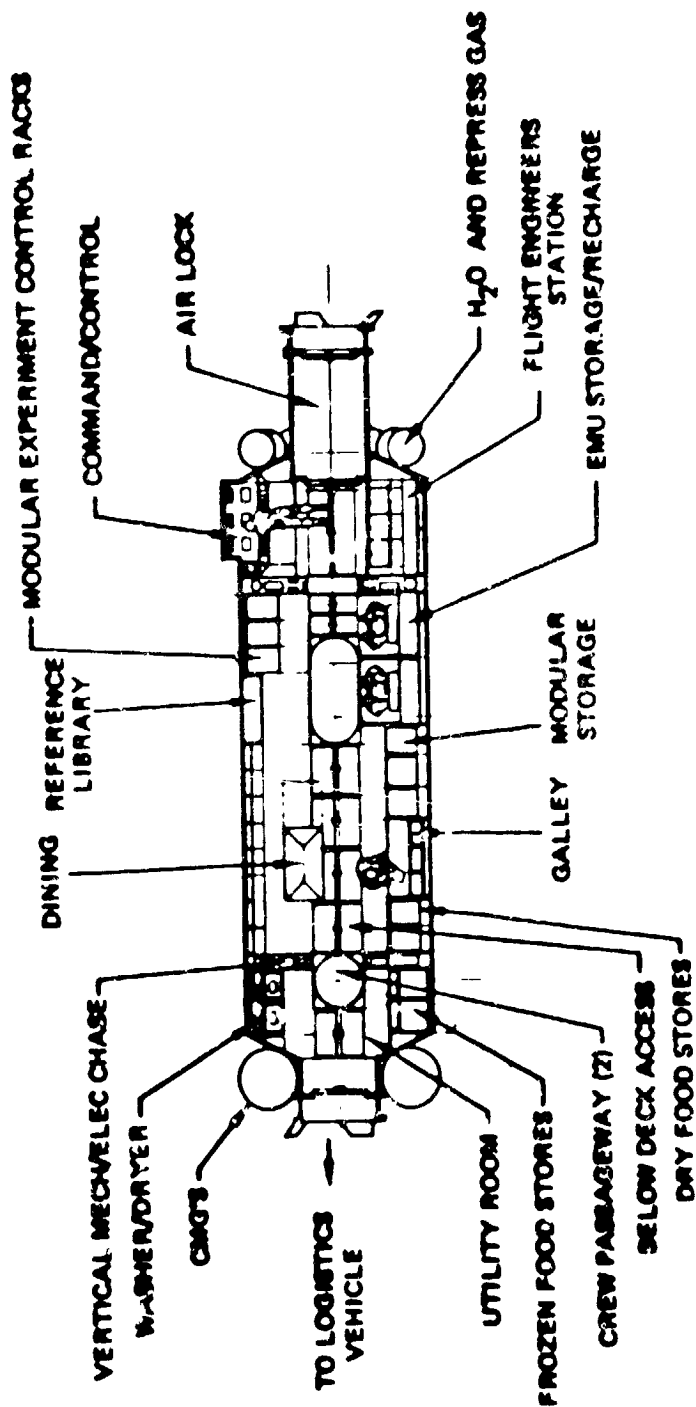




Space
Station

Unified Module Shown in Command/Control Layout

NASA 8710



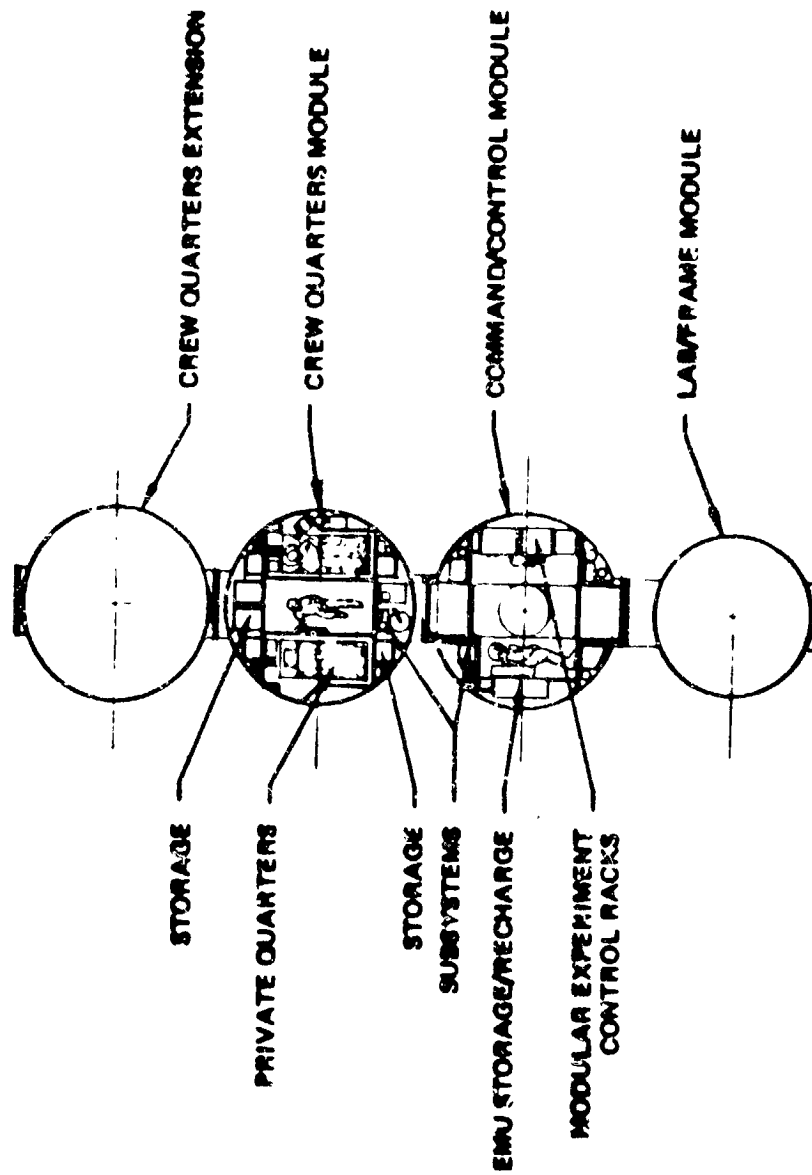


Space
Station

Transverse Section Unified Architecture

NASA

SS 711



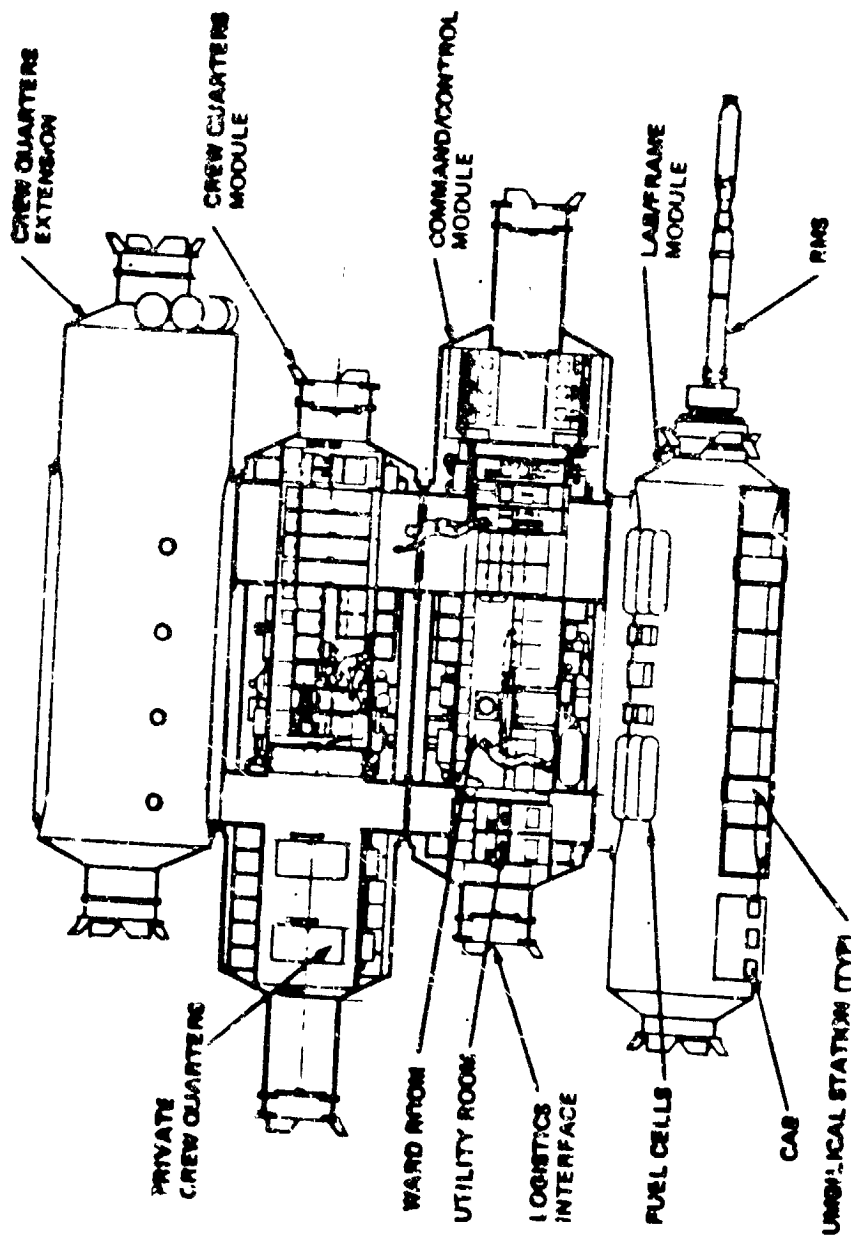


Space
Station

Section View of Crew Quarters and Command/Control Modules

NASA

1-712



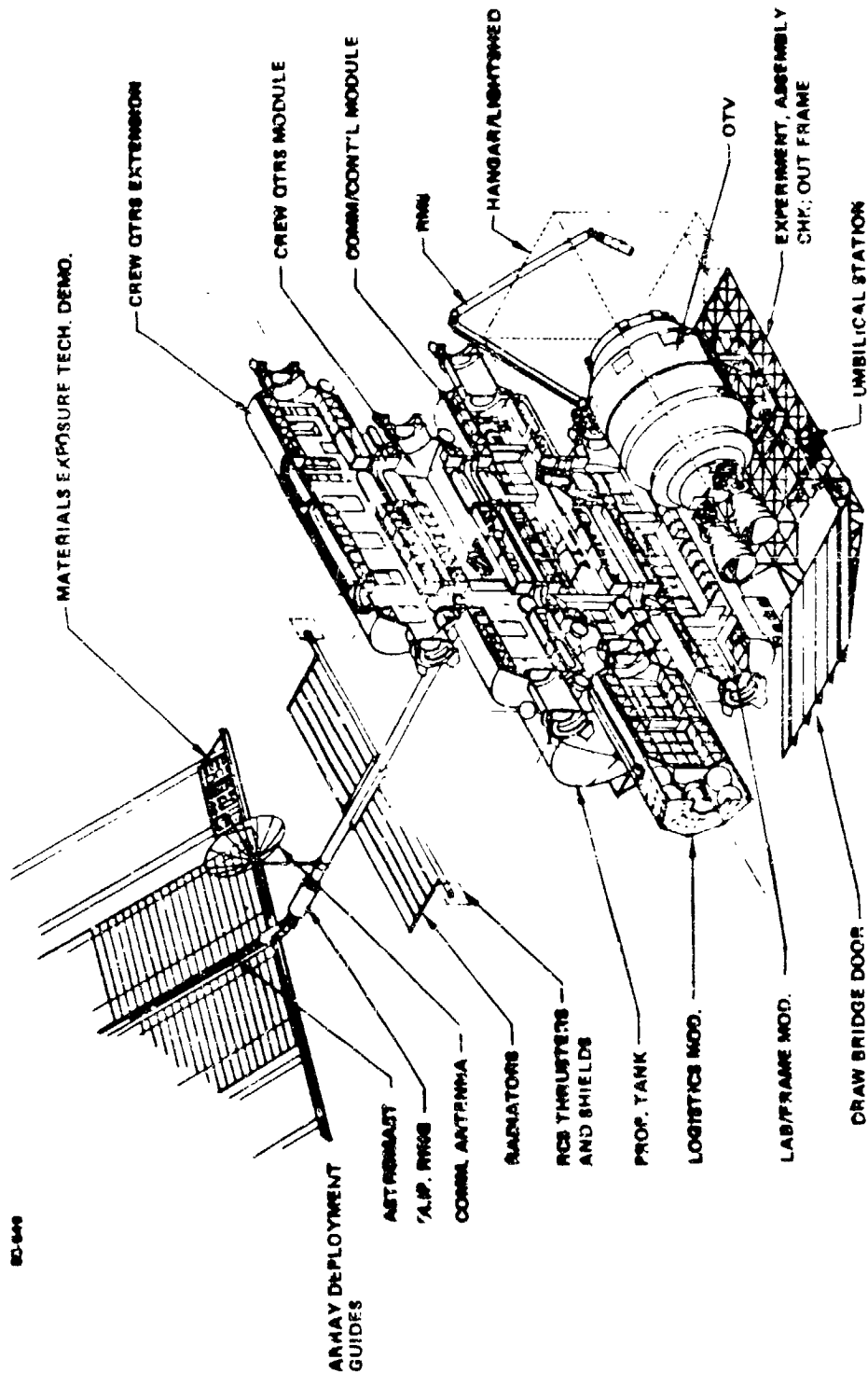


Space
Station

Cutaway View of Unified Space Station Architecture





NASA

SI-649



Adjacency Matrix

WJW
9071-50th

	CLOSE PROXIMITY
	MODERATE PROXIMITY
	SEPARATION
	NO PREFERENCE

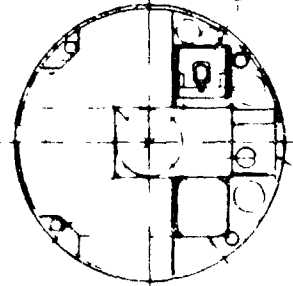
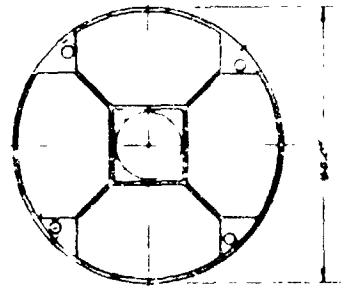
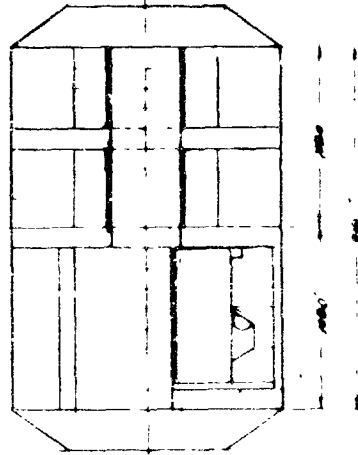
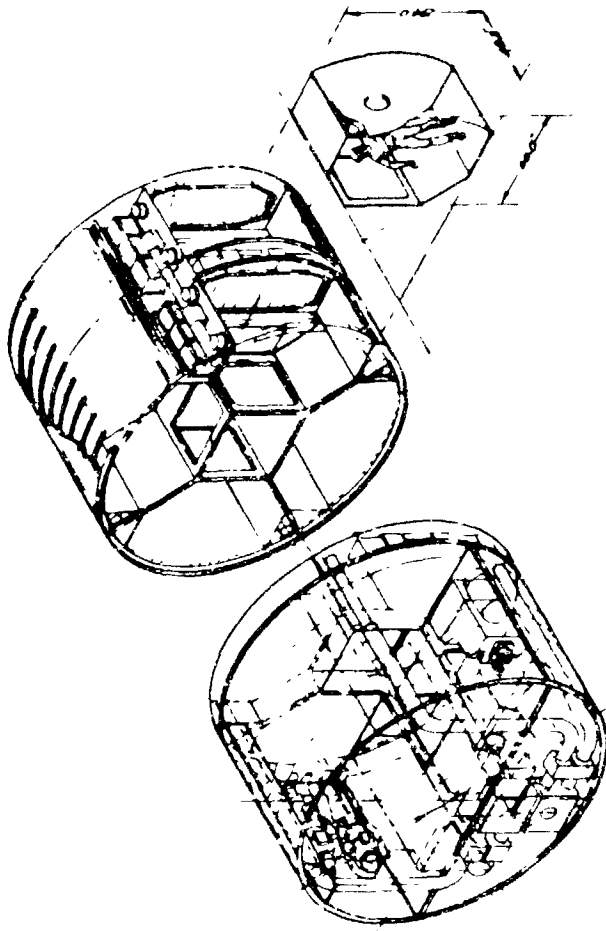


Space
Station

Space Station Common Module (Quiet)

NASA

SS-1101

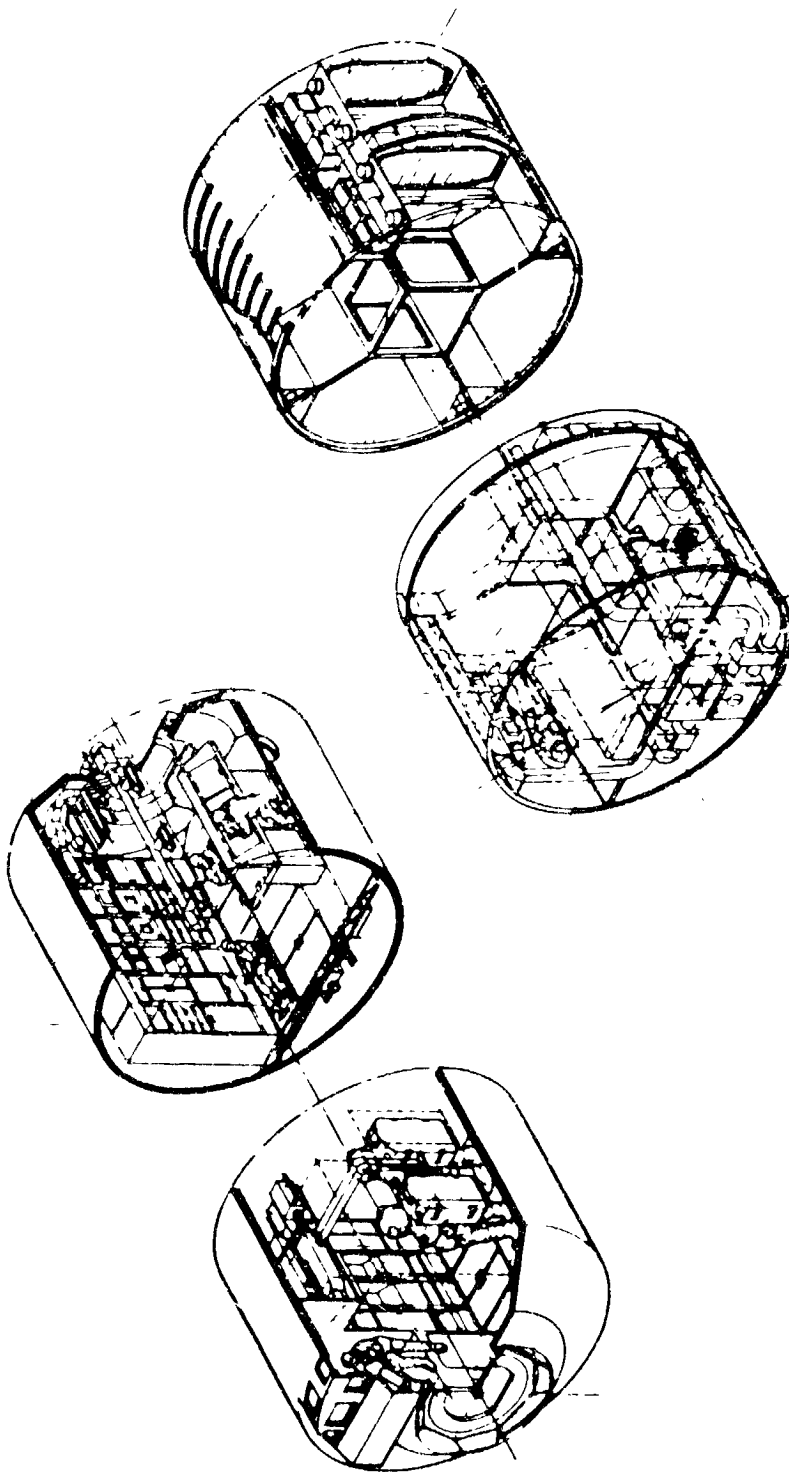




Space
Station

Space Station Common Module

NASA
SS-1002



ACTIVE

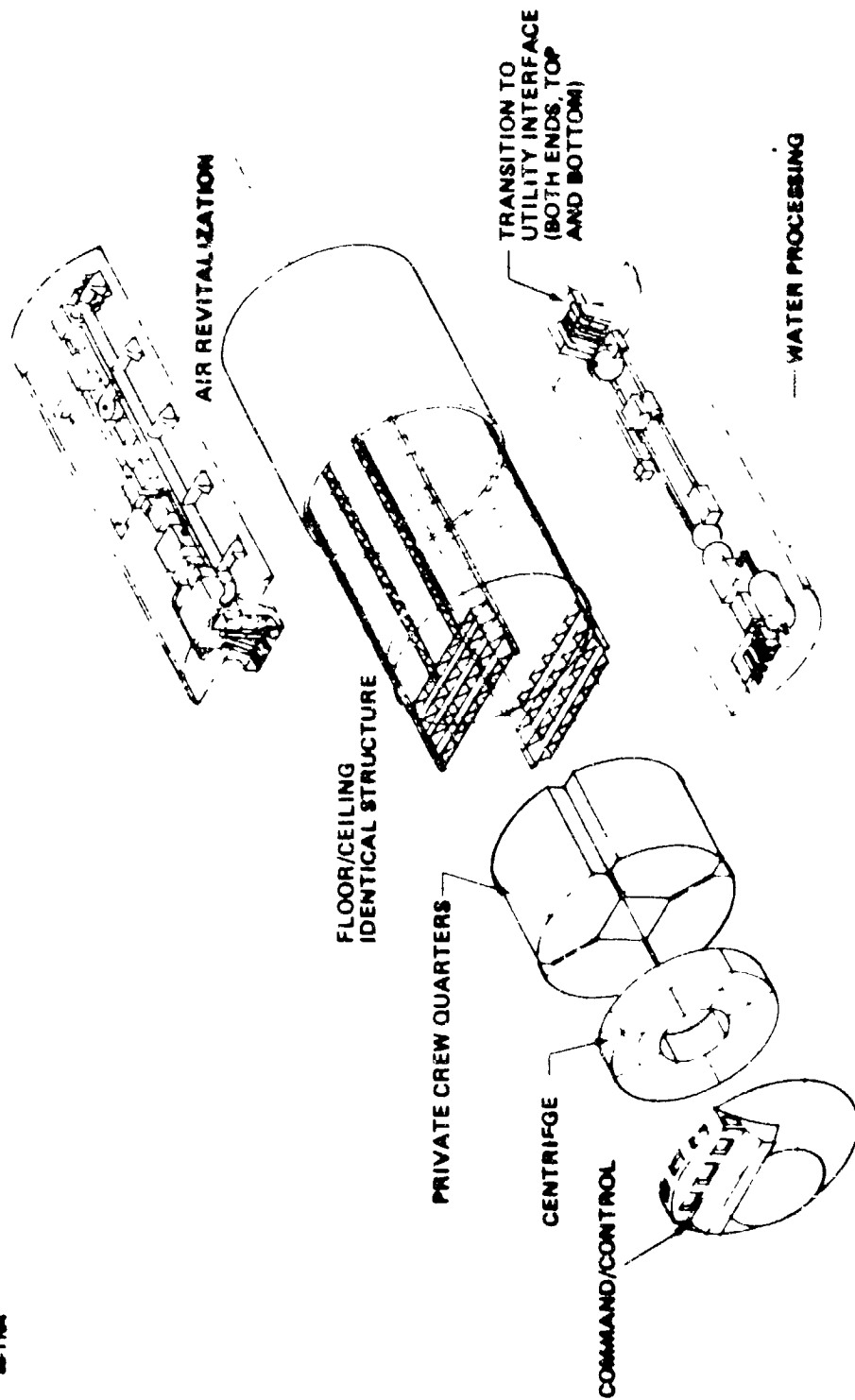
QUIET



Space
Station

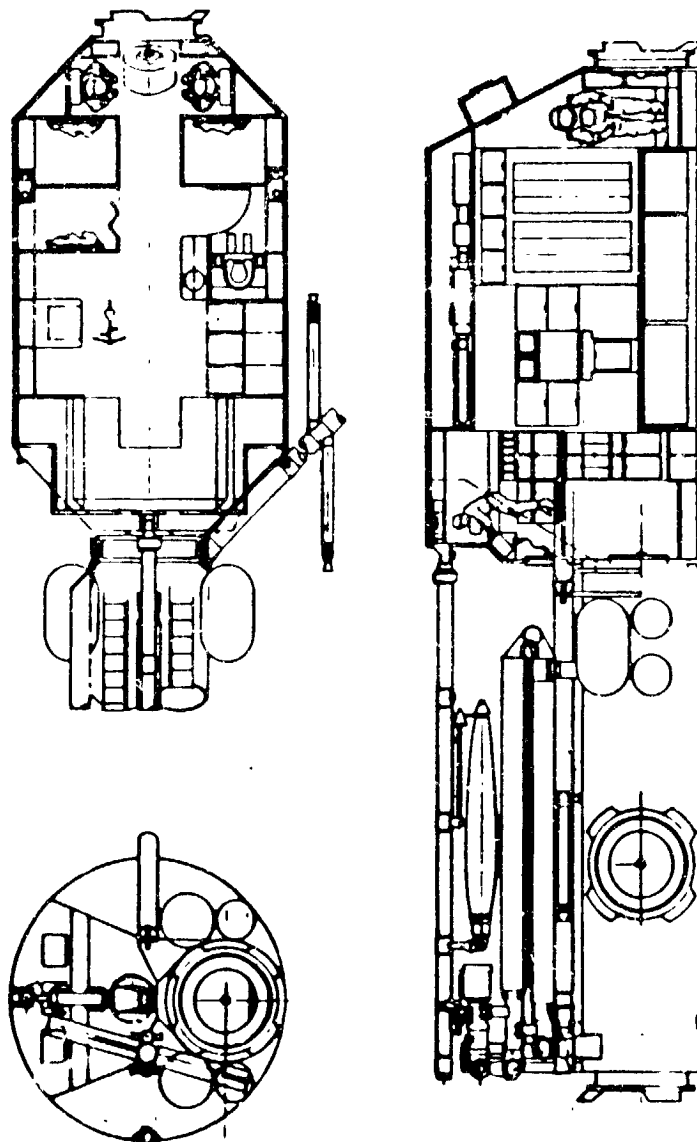
Common Module Elements

NASA
SS-1104



SPACE OPERATIONS CENTER Interior, Single Launch Space Station

NASA
DOC-1424

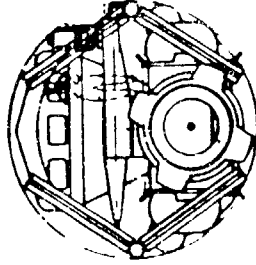
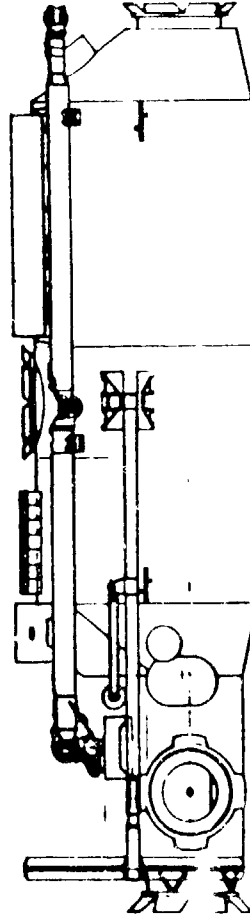
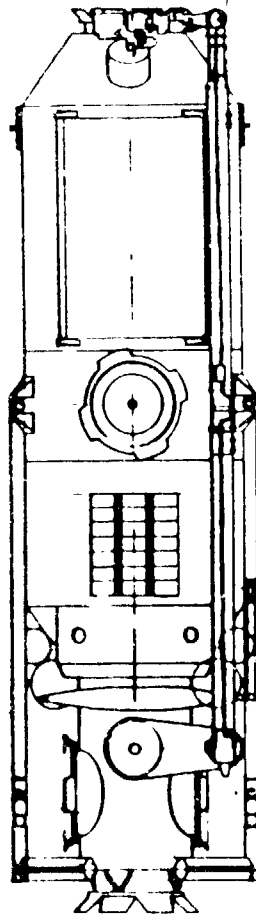


4-164

**SPACE
OPERATIONS
CENTER**

Reduced Diameter Single Launch Space Station

NASA
DPC 1478



SPACE OPERATIONS CENTER

NASA
SOC-187

Habitable Service Module Evolution



EMERGENCY
EQUIPMENT
ADDED



SOC REFERENCE
SERVICE MODULE



CREW PROVISIONS
ADDED TO PERMIT
EMERGENCY
SURVIVAL

FIRST ATTEMPT
REPACKAGING



DESIGNED TO SUPPORT
FUNCTION WITH A
HABITABLE MODULE;
NOT A "SAFE HAVEN"

TWO-DIAMETER
DESIGN ACCOMMO-
DATES TWO PEOPLE
BUT DEPLOYMENT
IS COMPLEX

SECOND
REPACKAGING



3.8-METER DIAMETER
ACCOMMODATES
THREE PEOPLE WITH
SIMPLIFIED DEPLOYMENT

4-160



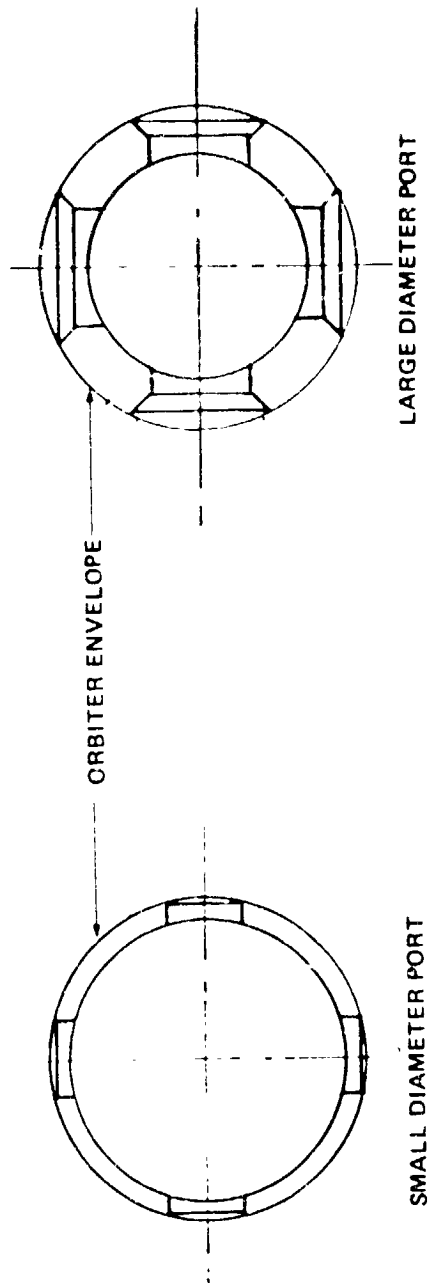
Space
Station

Docking and Berthing Ports

NASA

SS-1118

ASSUMING A "GIVEN" DESIGN FOR A DOCKING PORT:



SMALL PORT PERMITS LARGER DIAMETER MODULE BUT MAY
MAKE DOCKING/BERTHING MORE DIFFICULT.

LARGE PORT PERMITS EASIER DOCKING/BERTHING BUT REDUCES
DIAMETER OF MODULE.

PORT DESIGN NEEDS TO BE ESTABLISHED EARLY IN PROGRAM

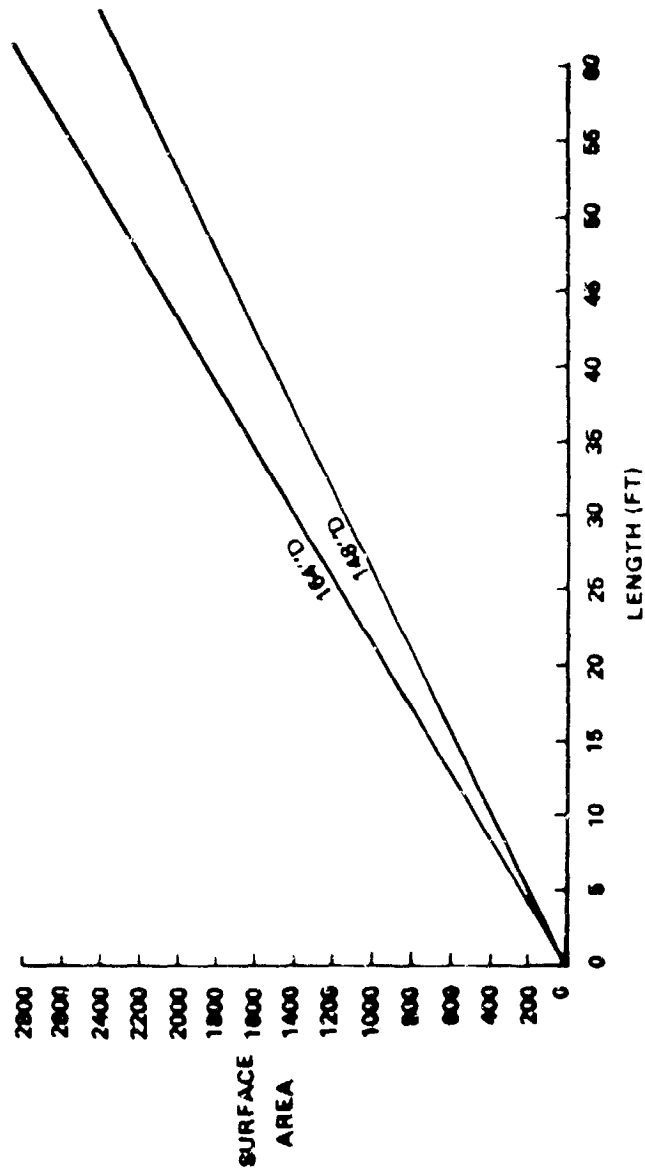


Space
Station

NASA

SS-1100

Surface Area Comparison for Two Space Station Modules

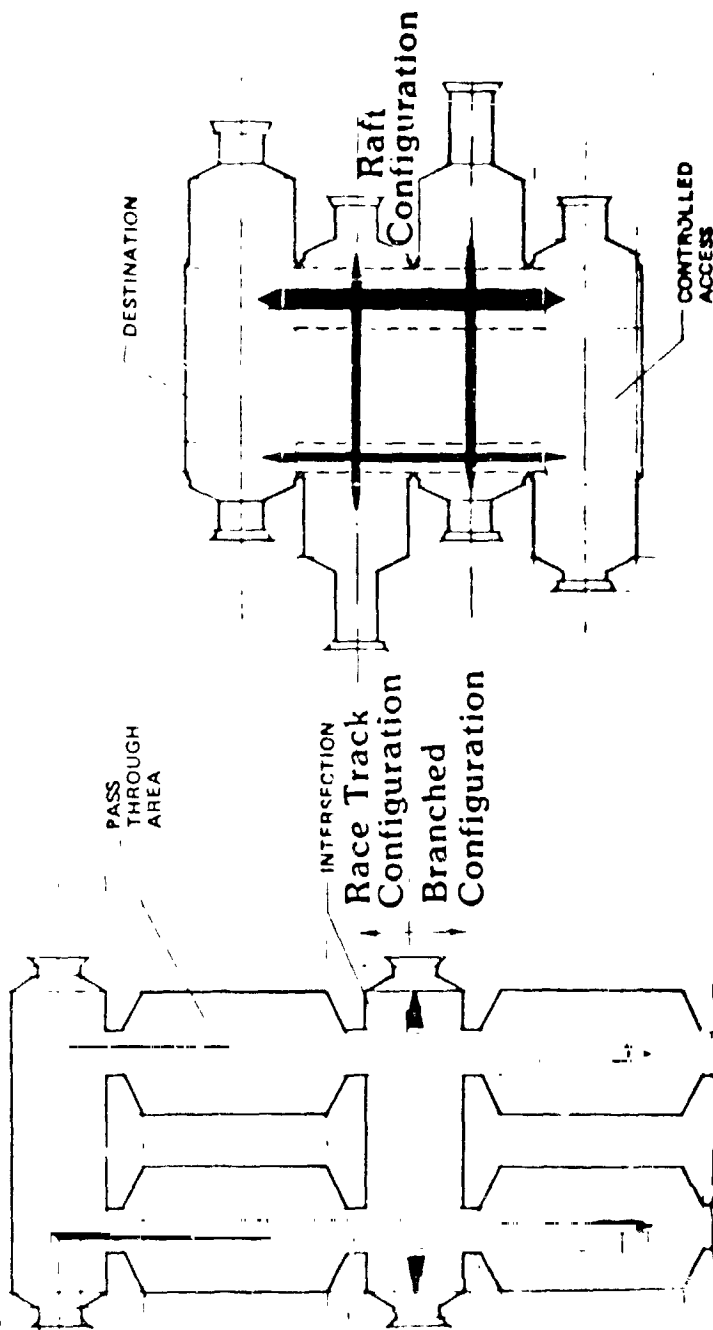




Space
Station

IVA Circulation

SS-1120



AXIAL CIRCULATION

- RACE TRACK--ALL AREAS ARE PASS THROUGH
- BRANCHED--CAN ARRANGE PRIVACY ALONG AXIS AWAY FROM CORE

TRANSVERSE CIRCULATION

- MINIMUM INTERRUPTION TO ACTIVITIES IN MODULE
- BETTER PRIVACY GRADIENT (CONTROLLED ACCESS)



Volumetric Efficiency

SS-1119
USMA

